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POPULAR AVIATION

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America's Leading Air Magazine

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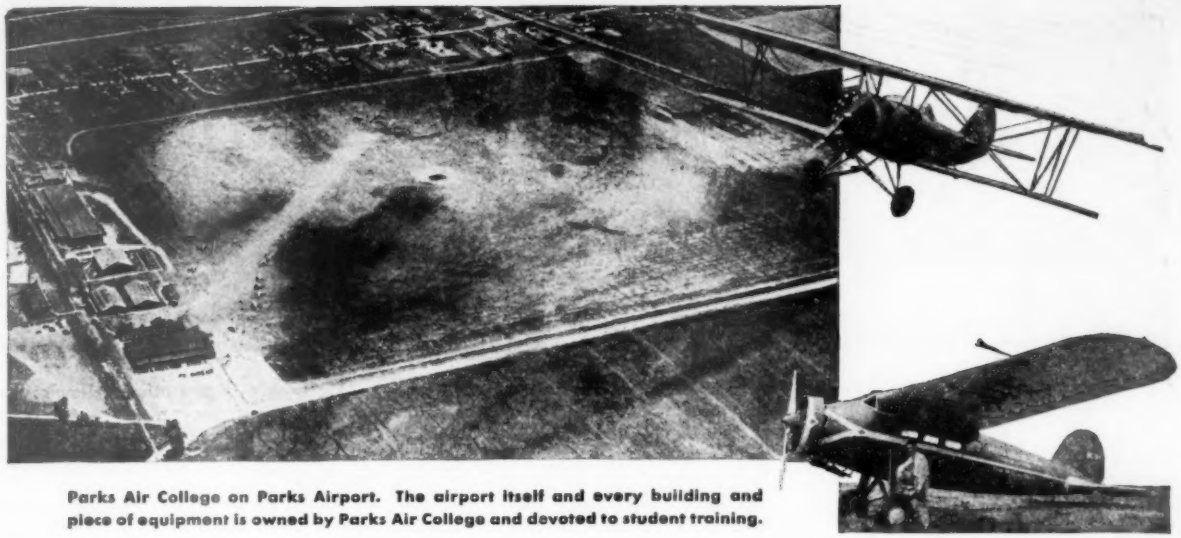

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An Airy Chat With the Editor

THIS season has witnessed an unusual number of pylon polishing events, all of them well attended despite the depression, but nothing of particular note has taken place.

According to the promoters and the friends of these carnivals, the races are proving grounds for new ideas that must be shot around the pylons before they can be conferred upon the aviation public. And so, we'll be waiting for the big developments in airplane design that have had their origin in these races.

* * *

BY FAR the most interesting feature of the Chicago Air Races, held in Chicago during the first five days of July, was the young tornado that broke loose early on the morning of the second day.

This gale, coupled with a downpour of water and cracked ice, provided a lot of excitement that was entirely lacking in the races themselves. It was just a good old Chicago monsoon that wrecked several ships at the Municipal Airport and raised havoc with the grandstands.

What aviation needs most, and this was one thing proved by the air races, is a grand-stand bearing an Approved Type Certificate from the Department of Commerce accompanied by a stress analysis.

* * *

OUR office, during the past month, has been honored by visiting aviation celebrities. Among them may be mentioned Lieut. Commander Weems, of navigational fame; Dr. Snyder, inventor of the Arup; John Van Vliet of bird flight fame; and many others, too numerous to list here. And by the way, Dr. Snyder tells me that the single-seater Arup will be produced for $1000, while the two-seater will sell for about $1800.

* * *

AMONG the rubber-stamp wisecracks in aviation is the threadbare utterance of the amateur airplane designer, "Stable? Say, fellow, she flew hands-off the first time she took the air."

And from the indignant air and the dirty look that accompanies this declaration, one would think (if inexperienced in the annals of aviation) that the only way to get this ship out of the air would be to take a club and beat it down.

But mostly, this is at variance with the true facts in the matter. We've been around flying fields a long time, and with one exception do not remember where it was not necessary to do a whole lot of tuning-up and adjusting after the trial hop.

* * *

NEATLY typed on a beautiful sheet of blue paper we find the following missive from one Alexander Beatty, Rochester, N. Y. Mr. Beatty seems highly peeved at our stand against air-races, and well he may for he himself conducts an aerial circus. Let us listen unto his priceless pearls of wisdom.

Say, what do you fellows mean by knocking the only money making branch of aviation? If it wasn't for the air circuses and race-meets, the public wouldn't know what an airplane was.

I have been six years in aviation, barnstorming mostly if that is what you want to call it, and I am still alive and able to write this letter. When you get down to the facts in the matter, stunting and dog-fights are the only things that the public are interested in. If flying exhibitions went out, then the airplane would go with them.

I don't see why you stand up for commercial aviation against the only legitimate line in the game. Just try to sell some of your airline stock today and see what you will get for it. Private planes are the baloney—you don't get anywhere with them and never will. Why? Well, because there is no money in private planes and who is sucker enough to spend several thousand dollars just to ride around in a plane?

You say that the races and stunting keep people from buying planes. Well, what of it? If they are so easy scared as all that, they had better stay out. If they want to go riding let them buy a flivver and ride around in that. They would only gum up the air, anyway.

There are not so many accidents at air-races. More get killed in the auto races, just as they killed five men at the last Indianapolis 500 mile race.

Well, this is the other fellow's version of the story which we set forth for your assimilation. However, it is hard for us to believe that racing and stunting are the foundation stones of aviation and it is equally hard to believe that the wonderful efficient airplane would pass out with the passing of the air circus.

* * *

JUST one more hunk of clay has been thrown into aviation by the Illinois solons. From this time on, air passengers will be compelled to give their names and addresses before starting out on a trip, no matter how short that ride may be. Even passengers on sightseeing trips will be compelled to sign on the dotted line.

Now, this undoubtedly has a bad effect upon the morale of the passengers, particularly those who are taking their first ride. It confirms their worst fears that flying is dangerous, and signing the roll in their minds is more or less like signing up an obituary notice. Wonder what the next shot will be from the Meddlesome Matties of Illinois.

* * *

HERE is another inquiring reader who don't like the present list prices on lightplanes. This is not the first letter on the subject by any means, but it is a pretty good letter and we'll let it go at that.

Last week I purchased a beautiful and peppy little automobile for $645. It is beautifully fitted up inside with fine unholstery, nice instrument board, ventilators and all sorts of well fitted accessories. It has a peppy little 8-cylinder engine that propels it along at a high rate of speed.

Now just compare this wonderful little car with one of the cheapest lightplanes on the market. This plane is an ugly looking affair with the cheapest and crudest attempt at finishing. There are a few steel tubes, some linen fabric and a dinky little 2-cylinder engine stuck up in front that is no comparison with the 8-cylinder automobile engine, and yet these people have the consummate crust to charge nearly $1,500 for this abomination!

(*Continued on page* 201)

XUM

POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

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Line Squalls, the T

by

ROMAN J. MILLER

Lieut. Commander

U. S. Navy, (Retired)

The ill fated Akron hovering above Washington, D. C., shortly before its last cruise.

IN THE dark hours of midnight, April 3rd, 1933, the colossal Airship *"AKRON"* was torn asunder in a violent electrical storm and plunged into the icy waters of the Atlantic Ocean. Admiral Moffett, Chief of the Bureau of Aeronautics and seventy-three gallant officers and men perished in a great pioneering adventure for the cause of aviation.

Lest their supreme sacrifice be in vain, there should be a new determination to solve the airship problem. If the writer understands the true spirit of our departed heroes, he believes they would be unanimous in a desire for our nation to "carry on" the march of progress.

In the face of a tragedy which has stunned the world, it is rather difficult to present an agreeable and convincing argument as to the merits of future airships. However, even the most skeptical must admit that the remarkable flight of the Graf-Zeppelin around the world in twelve days of flying, and some twenty-eight scheduled flights across the Atlantic in all sorts of weather, demonstrates beyond a doubt that there are tremendous commercial possibilities in this type of craft.

The new method of construction and design, as embodied in the giant new Airship *"MACON,"* is fundamentally sound and adequate for flying in practically any kind of weather. However, the aerial ocean, in which all manner of aircraft must fly, is as yet only partially charted. I refer especially to violent electrical storms, commonly referred to in Naval parlance as—*"Line Squalls."*

To better understand airship navigation problems, let us review with the eyes of an aeronaut in a nontechnical manner, the prevailing winds and storms of the earth. These winds and storms bear an important part in the successful development of the aerial commerce of the future.

It will be revealed from the study of "Ocean Meterorology" that when any large portion of air is put in motion, it is called a "wind." All winds, whether hurricanes or gentle evening breezes, are caused directly or indirectly by the changes in temperature of the land or sea over which the air exists.

Thus, when from any cause, two neighboring regions of land, sea or air become unequal in temperature, the air of the warmer regions being lighter, will ascend and spread out over the top of the colder air, while the heavier air of the colder regions flows in to occupy the space left vacant, so to speak, of the warmer air.

A motion of air or wind is thus produced, the velocity of which will depend on the difference of temperature between the two regions. The greater the difference of temperature between regions, the greater will be the velocity of the winds. These winds—one blowing from the cold region to the warmer, along the surface of the earth, the other from the warmer to the colder in the infinite upper regions of the atmosphere,—will continue to blow until equilibrium is restored.

Another effect of the warm air ascending to the upper strata of the atmosphere, is to cause the formation of clouds. As the air rises it expands and in doing so it is rarified and cooled. Its vapor is then condensed into clouds or else precipitated as rain.

WINDS are, as a rule, classified as *constant*, *periodical* or *variable* and are named according to the direction from which they come,—that is, from the true bearing of the wind. Thus a wind coming from the North is termed a "North Wind," one coming from the East is termed an "East Wind," etc.

The "Trade Winds" belong to the classification of "constant" or per-

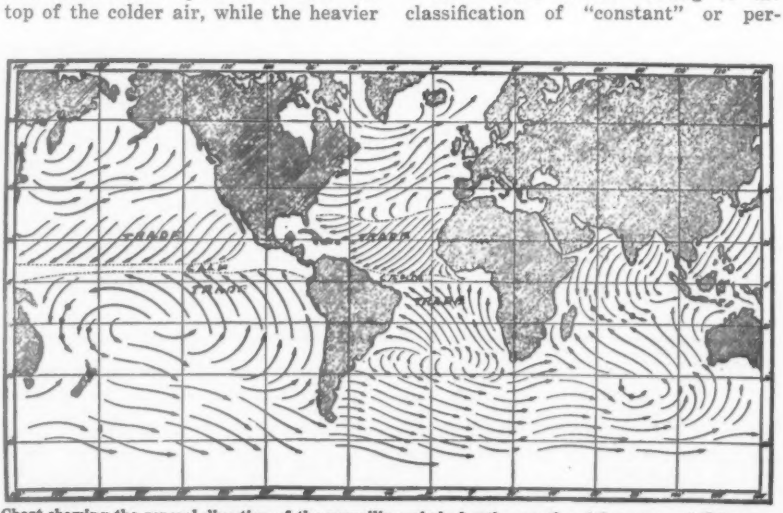


Chart showing the general direction of the prevailing winds for the months of January and February. Note the trend of the Trade Winds and the calm areas between them.

Terror of the Air

LINE Squalls and thunderstorms are the two uncontrollable menaces to airship navigation and aviation. The tremendously rapid air currents set up by these atmospheric disturbances can and will rend the firmest airship or airplane structure.

The author gives an intimate description of these winds and describes the destruction of the Akron and Shenandoah by these demons of the air.

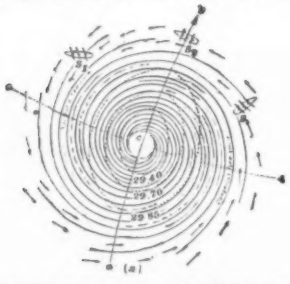
manent" winds. They are perhaps the most important in so far as aerial routes overseas are concerned. The name, "Trade Winds" was evidently given on account of the great service they have rendered commerce and navigation in the days of the old sailing ships.

The Trade Winds blow unceasingly from a general Easterly direction. Their area of operation extends from about 30° North to 30° South of the Equator, with a belt of calm area between known as the "Doldrums."

An interesting theory is advanced as to the probable cause of these permanent Easterly winds. It is well known that warm air is lighter than cold air. Consequently the atmosphere at the Equator, being heated, will rise and in its place flows cold air from the direction of the Poles as indicated in the accompanying sketch.

A circulation of air is thus established, one current flowing from the Equator toward the Poles in the upper regions of the atmosphere, and another current flowing toward the Equator from the Poles along the surface as indicated by arrows. If the earth were at rest, a northerly surface wind would consequently prevail in the Northern Hemisphere and a Southerly surface wind in the Southern Hemisphere.

But, these directions are modified by the earth's rotation. The rotation of the earth upon its axis from West to East naturally draws this volume of



A hurricane in the northern hemisphere in which arrows indicate the direction of the wind. To the right of a-b is the "dangerous semi-circle."

BELOW. Showing the tremendous leverage exerted on a dirigible by the air currents circulating about a line squall. ABOVE. A metal framed dirigible is immune to danger from lightning.

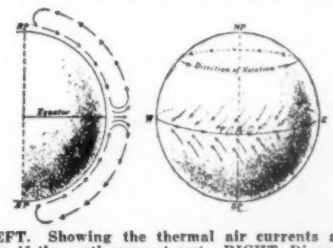
air to a semi-vortex, giving it a general Easterly drift on each side of the Equator and for an area of about 30° of latitude each side. The region of the trade winds is seldom invaded by storms.

Only light clouds by day, while the nights, as a rule, are practically cloudless and admirably adapted to star observations. There are times when the trade winds have a tendency to weaken or shift, this probably being caused by disturbing counter-currents of air outside their borders. But as a general rule these winds blow with remarkable constancy of velocity from a general Easterly direction.

Trade Winds played an important part in the early development of the Mercantile Marine. They are destined to play an equally important part in the development of the aerial commerce of the world.

The advent of the steamship reduced the value of the prevailing winds of the world in so far as surface crafts are concerned. But the airplane and the dirigible, being subject to the influence of prevailing air currents, will again bring these winds into prominence.

THE "Doldrums," previously mention, is a region of calm, occupying



LEFT. Showing the thermal air currents and flow if the earth were at rest. RIGHT. Diagonal flow of the Trade Winds due to the earth's rotation.

an area from 1° to 9° of latitude North, but adjacent to the Equator. It is a region of calm, sultry air, occasional baffling breezes, and frequent tropical rains. Many instances are on record where sailing ships have been detained in these calm regions for weeks in a state of painful helplessness, the crew being unable to do anything but wait patiently for a breeze to fill their flopping sails, the water all around them resembling an infinite waste of glassy, smooth surface, slowly rising and falling with the monotonous motion of the sea.

Then there is a region of light variable winds and occasional calms prevailing at the outside borders of the trade winds, both in the north and south latitudes. This region is commonly known among seaman as the "Horse Latitudes." It is a region of comparatively clear and fresh weather.

Outside of the "Horse Latitudes" and all across the temperate zones of both hemispheres, Westerly winds predominate. These are frequently interrupted by storms and occasional shiftings. But taking the average of wind directions say for a year, the resultant of the several wind components during that period will be Westerly. These westerly winds may be referred to as —"Anti-Trade Winds."

An example of the importance of course selection in regard to prevailing winds is gleaned from the fact of the great difficulty encountered by aircraft when attempting a Westward flight from Europe to America across the North Atlantic. These difficulties were no doubt partly due to the strong prevailing Westerly winds of the North Atlantic retarding the aircraft's ground speed to a dangerous ratio.

A classification of a more peaceful nature is known as "Land and Sea Breezes." These breezes are probably caused as follows. During the day, the land is heated more rapidly than the sea and during the night it is more rapidly cooled. In the morning, therefore, the air over and near the land, being heated by the sun will rise and colder air from the sea will flow in to supply its place. This produces the sea breeze of which so many of our coast cities boast during the day.

During the night and shortly after sunset, the land becomes colder than the sea and the flow of the cold air will begin to move seawards to take the place of the warm air of the sea. This movement of air produces the land breeze.

The writer had an interesting experience on one occasion, testing out the principle of land and sea breeze in a U. S. Navy free balloon near San Diego, California. Leaving the station with a crew of four in the basket of a balloon, he sailed inland for several miles then back over the bay and out a few miles at sea. By chang-

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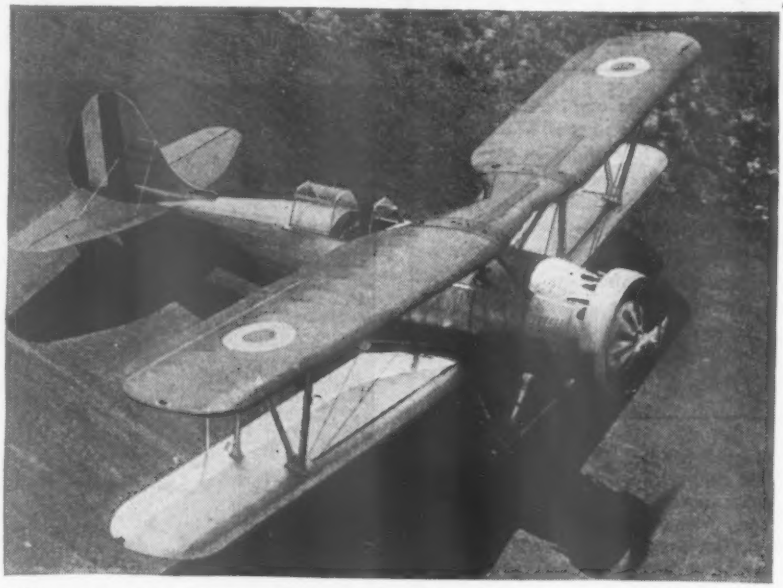
Vought Produces a New Corsair



A three-quarters view of the new Vought Corsair Fighter, Model V-80, which maintains many of the Corsair characteristics though the design is somewhat modified in detail to meet certain special conditions. It is a single-seater, powered with a 700 h.p. Hornet engine.

FLIGHT tests have just been completed on a new single-seater "Corsair" fighter, produced by the Chance Vought Corporation, Hartford, Connecticut.

This airplane, known as Model V-80, has been developed to meet the conditions encountered in many foreign countries having relatively small air forces and few airdromes, which are often widely scattered and difficult of access by land. For reasons of economy, it is highly desirable to keep the number of types of aircraft at a minimum and the principal offensive aircraft in these air forces, therefore, are single-seaters and two-seaters, which between them, fulfill the functions of pursuit, observation, bombing, and attack aircraft.

Moreover, because of the scattered and inaccessible location of airdromes, transportation of spares becomes a difficult problem and interchangeability of parts is most important so that the quantity of spares may be kept at a minimum. Still another controlling factor, also due to the scarcity of airdromes and the unfavorable terrain, is the necessity for long cruising range to insure maximum mobility of operating units.

For those air services already equipped with two-seater "Corsairs," the single-seater V-80 fulfills these requirements in a highly satisfactory manner. It is a direct development of the two-seater "Corsair," using the same skeleton fuselage, wings, tail, landing gear and many other items of equipment, all of which are interchangeable between the two types. It inherits the high performance and maneuverability characteristics that have made the two-seater "Corsair" internationally known.

It is heavily armed, carrying four fixed machine guns and two bomb racks, so that in emergency it can perform attack or bombardment functions in addition to pursuit. It has a fuel capacity of 173 gallons, far more than the usual single-seater and sufficient for a cruising range of more than 800 miles.

The power plant is the Pratt & Whitney TIC-1 "Hornet," rated at 700 H.P. at 2000 R.P.M., sea-level. It is cowled with an anti-drag ring and is provided with a Hamilton Standard metal propeller and an Eclipse electric starter.

The V-80 is equipped with a transparent cabin for the cockpit, providing maximum speed and insuring comfort

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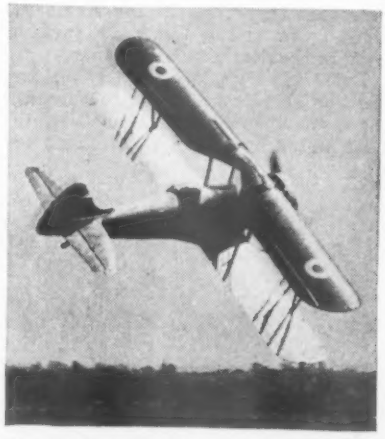


The new Corsair in flight. It has an excellent take-off among its many other performance features, and is highly maneuverable.

Flying With the Coast Guard

by HAROLD M. FARKAS

Under conditions that are even more thrilling than in the Army or Navy air services, the Coast Guard flyers patrol the coast and water bordering on the United States.

THERE was a sick man aboard the steamer E. R. Kemp, out in the Atlantic 200 miles off the coast of Florida. So ill, that the Captain wrinkled his forehead and worried.

There was no doctor aboard the Kemp because it was, after all, only a tramp steamer from Houston on the way to New York and the sick man was the second engineer.

"Cap", the sick engineer gasped out, "I'm afraid you're going to have a dead one on your hands. When appendicitis gets this bad, it can't wait. It may bust inside o' me."

The Captain saw that his engineer's eyes were yellow. He called one of the crew to bring more ice to the sick man. Then, "Maybe we'll run across a Clyde liner going to Miami," he murmured. "They always carry doctors aboard." But the engineer as well as the Captain knew they would never come across a Clyde liner in the lane through which they were pushing.

Turning from the bunk, the Captain went aft to the radio room. He found the operator, tense, nervously fingering his instrument with one hand, writing with the other. The Captain waited. Would the man never get done clicking? Finally, the operator tore the head-piece from his ears and spoke in a voice which sounded like the tick-tack of his own instrument.

"From the Coast Guard flyers at Miami, sir. They leave at once. Will meet us in about an hour and a half at Ponce de Leon Inlet. They're bringing along a doctor."

Relieved, the Captain took out a pocket handkerchief, wiped the sweat and worry from his forehead. "Good work, Jones," he complimented the operator, then retraced his steps to the engineer's bunk.

One of the most recent Coast Guard twin-motored flying boats built by the General Aviation Corporation. These ships are unusually sturdy and can land on heavy seas.

In less than an hour and a half, the Captain and the sick man heard the droning of twin motors in the sky. "200 miles from Miami to the Inlet," thought the Captain. "Made it in exactly an hour and twenty minutes," glancing at his watch. "What speed!"

THE United States Coast Guard amphibian "Arcturus" circled the Kemp twice and landed gracefully in the quiet sea, where she rode on the dark green waves like a contented duck. The Captain lowered a life-boat and with two of his crew personally conveyed the doctor and Commander Von Paulson of the Coast Guard to the gangway.

Following a brief examination of the engineer, the doctor said, "We must get this man to a hospital at Miami quickly. Glad you packed him in ice, Captain. That was a wise move."

Strapped to a man-sized mesh stretcher, used by the Coast Guard, the engineer was removed from the tanker to a life-boat and from the life-boat into the aft of the amphibian where he was nestled comfortably into a rubber air-filled mattress.

In slightly more than an hour the amphibian landed at the Miami base and taxied to the ramp where a waiting ambulance rushed the doctor and his patient to the hospital. An emergency operation was performed and a near ruptured appendix was removed successfully. The engineer recovered.

Coast Guard flyers are all heroes, but that is their duty. Rescuing the engineer from the bony fingers of death was just one incident in their daily routine. Our United States Coast Guard Aviation is the most specialized branch of the air-service. It is not a part of the Army, nor the Navy, nor the Marines, but belongs to the Treasury Department. Its functions are many.

To aid the injured and distressed in the lonely treacherous Gulf, in the bitter Arctic wastes or in the turbulent Pacific; to make surveys of destruction in the hurricane tracts of the Caribbean, in the Mississippi flood areas, in the tornado stricken Middle West, or in the California earthquake regions; to carry food, medical sup-

Coast Guard flyers removing the sick engineer from the hull of the "Arcturus." This is an actual photo of the incident and shows the mesh stretcher.

plies, Red Cross aid and other necessaries to storm sufferers in the United States and adjoining territories; and especially in Florida, to search for lost at sea in little boats, where death from thirst, starvation, exposure would surely result.

Coast Guard cutters, greyhounds of the sea, are fast, and can easily make 150 miles in eight hours. But a Coast Guard amphibian is one of the swiftest craft in heaven or on earth or sea and can cover from 800 to 950 miles in the same time.

FRANTICALLY rings the telephone at the Coast Guard base in Miami. A terror stricken voice calls, "Oh, please try to find my husband and boys. They have not returned home tonight from a fishing trip."

The Coast Guard flyers leap to the rescue. They find a fourteen foot yacht tender disabled in Biscayne Bay, just twenty minutes after receiving the call. The flyers found the boys suffering from exposure. They gave them first aid and after landing them at Miami, sent a Patrol boat to tow in the disabled craft.

Another time, the flyers searched until dark for one boat and could not find it. At streak of dawn, the next morning, they continued the search. Finally the craft was sighted; a white motor-boat with four men making distress signals. The radio operator in the plane telephones or wirelesses the Patrol station which sends a cutter to the motor boat's assistance.

Coast Guard flying involves more than just a game of playing the hero. Hardship and peril follow in its tracks. Occasionally a chance must be taken by the pilot. When the question arises as to whether the plane should hazard a landing in the open sea or leave the man for whom they are searching and have found, to certain death, there is only one answer, "We will risk it," and down the plane goes, every man at his post, ready to meet death if necessary in the performance of his duty. Of course such cases are rare.

But every once in a great while the rarity turns up, as in the case of January 4, this year. The aviation base at Miami received a radio message from a Coast Guard wireless station at Chester Shoals, Florida.

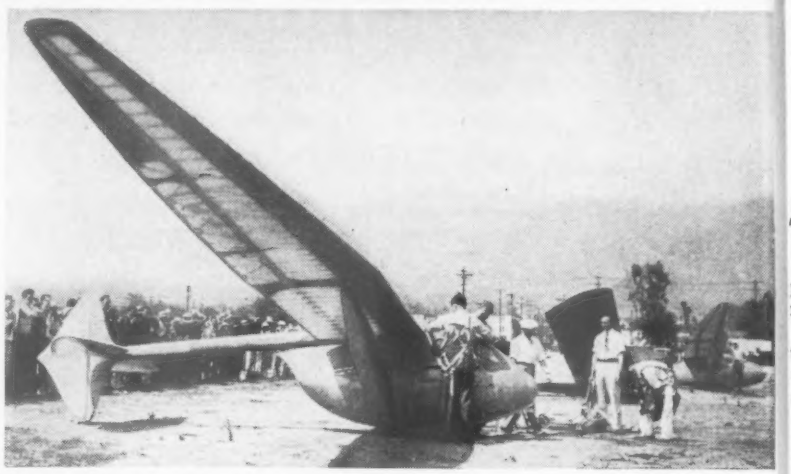
"Boy in skiff blown offshore last night inside of Cape Canavarel. Two fishing boats searching without success."

Commander Von Paulson left Miami at noon in the amphibian, "Arcturus." With him were Lieutenant W. L. Foley; mechanics. James Orndorff, Jr., William Pinkston, and radioman Thomas McKenzie.

"A bad day to search for a lost soul," pondered Commander Von Paulson as the "Arcturus" ran into squalls, heavy rains, strong head winds and high run-

(*Continued on page* 206)

Building Sky Cars for Aerial Trains



The tow gliders employed in these experiments are of unusual construction. Note the tail booms, the short chunky nacelle and the back swept gull-wings.

OPERATING aerial express trains, consisting of a powered plane acting as the locomotive and towed gliders representing the cars of the train, has long been a dream of airmen. In fact, such a train once formed the subject of a POPULAR AVIATION cover design several years ago.

By employing gliders as trailers, a greater payload can be carried than with the single engined plane, and as a further advantage, the individual towed gliders can be cut loose independently at any point along a transport route for local service without the necessity of landing the main plane and thus interrupting the long distance express service.

Out at Glendale, Calif., successful experiments were conducted with the towed or trailer gliders shown here. Three of these motorless gliders were hauled aloft by a Curtiss Robin cabin plane without mishap. The pilot of the Curtiss Robin, or the "engineer" of the train, was Joe Plosser. The three glider pilots or "brakemen" were, Richard Dupont, heir to the Dupont powder millions; Hawley Bowlus, the glider expert and D. W. Wilson a transport pilot. These men are pioneers in a new branch of aviation.

Winnie Mae Makes Second World Tour

WILEY POST and the Winnie Mae are again victorious for they have broken their former round-the-world record. The time for the 15,000 mile trip was 7 days, 18 hours which is some speeding.

As explained in the last issue of P. A., Post was accompanied only by a robot pilot which relieved the strain of piloting over such a tremendous distance. It will be noted that several changes were made in the Winnie Mae,

Here's the revamped "Winnie Mae" on a test hop prior to her round-the-world trip. She's been cleaned up considerably, even to the removal of the windows on the side.

The Plane Gets a Mining Job

by
JAMES
MONTAGNES

Example of an aerial photograph taken over Great Bear Lake, showing the mineralogical features of this site. Taken by Canadian Airways Limited.

TO save time, money and hardship for the prospector, geologist and mining financier, aerial photography has been adapted to the needs of mining in Canada.

The first field to have the benefit of this new aid in the search for mineral riches is the Great Bear Lake radium, silver, gold strike on the Arctic Circle.

Situated more than three thousand miles from the larger eastern cities and 1,500 miles north of Edmonton, the last city on the way, time is a big factor in mining operations in this region. That is why this field was used to demonstrate the new method to the mining world, a method which is adaptable to any mining region, whether near or far distant.

Mining by photography was developed by Canadian Airways, Limited, and consists of taking vertical photographs of an area from a height of 9,600 feet, using a camera with a twelve inch focal length. This gives a series of pictures on a uniform scale of 800 feet to the inch. These photos overlap about fifty percent, making for greater accuracy when the whole series of pictures is built up into one large photograph. The large picture is called a "mosaic," having been built up, a photo at a time. This picture can then be photographed and reproduced to whatever size is required, giving an accurate photo-map of the region under survey.

The mining engineer, geologist or prospector can study the large picture for geological formations. He can find the hills and valleys, the mineralized areas and the possible location of certain minerals. This means that a careful study of a property can be made thousands of miles from the actual scene and the actual mining planned far from the strike.

To give an accurate birds-eye view of the region showing all hills, valleys, depth of lakes and rivers and landmarks, a stereoscope is used. The whole area can be thus surveyed or any part of it.

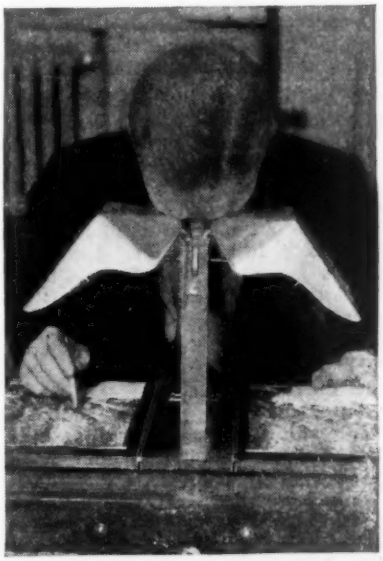
The stereoscope consists of two sets of mirrors, the lower set reflecting into the upper. Two similar photos are placed under the stereoscope, one under each set of mirrors. By looking down into the lower set of mirrors, the photos appear to be thrown up in relief and every part of the landscape takes on size, depth, and height. By carefully studying the series of photos in this way, very detailed geological information is obtained, enabling operations to be planned from the photos.

In order that prospectors and engineers may be able to do this photographic mining in camp, portable stereoscopes have been designed which will fold up and can be carried in a small field bag, along with the photos to be studied.

The aerial camera used for taking these mining photos can be fitted in any machine, requiring only an opening in the bottom of the ship, for the two sets of lenses, one on the camera, and the other for the operator to check the pictures taken by the camera.

The adaption of the stereoscopic principle for gaining contrast and basic "relief in these pictures is highly ingenious." This is the same effect obtained by the simultaneous use of both eyes.

Engineer folding portable stereoscope specially designed for examining aerial views in the field or office.



The stereoscope in use, the instrument scanning duplicate photos, thereby showing the areas in relief.

The Gas Tank Hazard

PROGRESS in overcoming one of the greatest hazards in aviation, fire resulting from broken gasoline tanks, is reported in the Air Commerce Bulletin, published by the United States Department of Commerce.

Pointing out that the problem of finding a crash-resistant fuel tank has been worked on for years by several governments, the article states that success is now in sight following the invention of a new product.

This product, known as "Thiokol," has the physical characteristics of rubber, but is not affected by gasoline and other solvents as is rubber. For this reason it is possible to use it to line the interiors of fuel tanks where it will be most effective in preventing leakage. Rubber cannot be utilized in this way since gasoline soon destroys it.

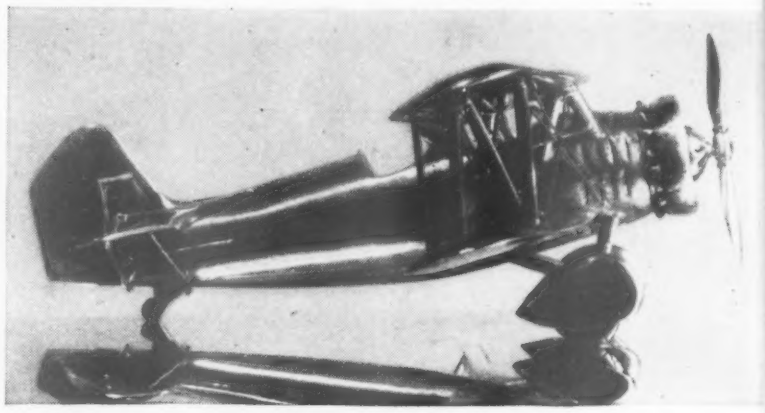
Previous to the development of "Thiokol" there was only one way of protecting fuel tanks on aircraft. Protective coatings made of materials such as strawboard, cotton fabric and various kinds of rubber were placed around the metal tanks. This method was obviously unsatisfactory. In spite of the heavy protective coatings the tank was unable to withstand much of a jolt. Another disadvantage was that leaks in the metal tanks could escape discovery and lead to accidents. Still another drawback was that the protective coating could be cut by the sharp edges of metal after the failure of the inner container.

In employing "Thiokol" several problems were met with, which as yet have not been solved. In view of the success attained in spite of these unsolved problems, it is believed that aviation's greatest danger will be eliminated in the near future as these difficulties are overcome. One of these is the sealing of the "Thiokol" inside the tank, and fitting it to the shape of the tank.

As yet no perfectly satisfactory cement has been developed to seal "Thiokol." To test the tanks equipped with "Thiokol," it was therefore necessary to mold it to fit the tank's interior. This, of course, was a difficult task and resulted in an uneven distribution of "Thiokol." In testing the tank, where breaks occured, they were found to be in sections where the lining was unusually thin.

In spite of the difficulties of lining the tank properly with this material the Bureau of Standards seems encouraged in having this product to work with. Although the tanks used in the tests were poorly lined with "Thiokol" they withstood, without damage, a drop twice that which was possible with other types of tanks. The use of "Thiokol" also resulted in a saving of about 25 per cent in weight in comparison with other crash-resistant tanks.

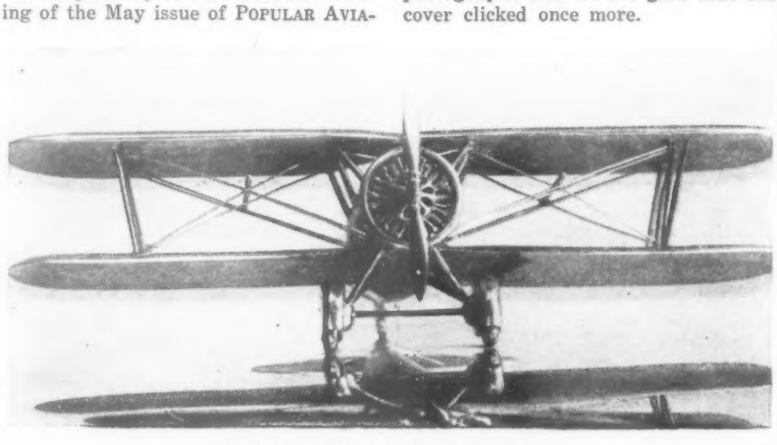
Silversmith Produces a Beautiful Corsair Model



Side elevation of the silver Corsair model.

MAKING good his promise, Mr. William Barthman, a jeweler of 174 Broadway, New York City, has kindly sent us photographs of the solid silver Corsair that he made as an ornament for a customer's silver cigarette box.

This beautiful scale model, as we mentioned in last month's Airy Chat, was inspired by the front cover drawing of the May issue of POPULAR AVIATION, and was built to scale from the scale drawings published in this issue. Mr. Barthman informs us that every precaution was taken to make it complete and accurate right down to the smallest detail and this care is indicated by the photographs. We take this opportunity to thank Mr. Barthman for his courtesy in sending the photographs and we are glad that our cover clicked once more.



Front view of the cigarette box ornament.

About the Old Fellows

AT WHAT age is a pilot at his best? Dr. Wade H. Miller, flight surgeon of the American Airways, says:

"I will frankly say that I do not know the maximum or minimum age for a good pilot. I have known men to learn to fly at 63 and others, no matter how young they started, who could never be good transport pilots.

"We used to think that a man was 'through' with flying at 35. Some of the best men in transport service are 40 or more. The fact is that the young pilot generally has the benefit of quick reactions, while the older pilot has the benefit of experience."

Dr. Miller emphasizes that good physical and mental condition are more vital factors than age.

He Has an Historical Collection

WILLIAM T. HOWELL, Jr., 1718 Parker Ave., Detroit, Mich., is conducting his model building along quite original lines. In short, he is making a collection of models based on historical ships, building a model of the most famous and outstanding plane of each year, starting with the Wright biplane of 1908 and following through down to the present year.

However, he is up against it for the years 1913 and 1914. He wishes to have an opinion on what planes were most famous during these two years and would like to get drawings of them. He is all fixed up on the 1912 and 1915 types. And so we turn this matter over to our readers.

Fourteen Years Ago

From U. S. Navy News Letter

FOURTEEN years ago, two huge flying boats were swinging at their moorings in the harbor at Trepassey, Newfoundland. A third plane of similar type was winging its way from Halifax, N. S., to Trepassey, where it arrived that afternoon. These were the NC-1, NC-3, and NC-4. Immediately upon arrival all hands turned-to to change an engine and shift propellers in the NC-4 because favorable weather for the proposed transatlantic flight was expected the following day.

The saga of that memorable flight, which indeed started that following day, will long be remembered. How the NC-1 and NC-3, running into far different than the expected good weather, landed to obtain radio-compass positions and found the sea too rough for the subsequent take-off. How the crew of the NC-1 were taken aboard a passing steamer.

How the NC-3 crew struggled through a heavy storm for two and a half days and finally were successful in sailing their battered plane to the Island of San Miguel, and how the NC-4 flew on through fog and rain and reached Horta in the Azores on the afternoon of May 17th after covering the 1,200 nautical miles in 15 hours and 18 minutes—an average speed of only a bit more than 78 knots and that due in part to a 15-knot tail-wind.

After several delays, due to fog and other unfavorable weather, the NC-4 reached her goal at Plymouth, England —the first airplane ever to have crossed the Atlantic Ocean.

When we bear in mind that since the first transatlantic flight, subsequent attempts have failed despite the higher speeds and accurate instruments in 32 of 57 attempts, we may well be proud of the U. S. Naval aviation personnel who set out so bravely fourteen years ago and who were successful.

An Engine Contest

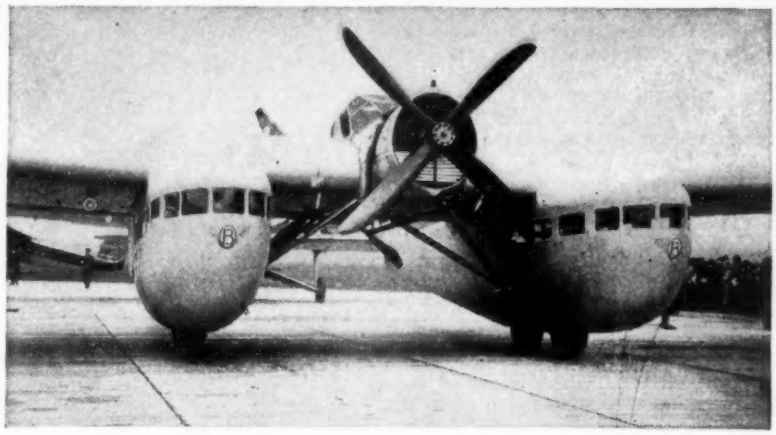
THE Masaryk Air League of Czechoslovakia, desirous of advancing civil aviation in that country, some time ago offered prizes for the construction of a cheap engine suitable for small private airplanes.

Tariffs on foreign engines made their cost prohibitive to the man of average means. As a result of the contest, two Czechoslovakian aviation concerns are turning out airplanes of the desired type which will cost the private flier only 50,000 crowns (about $1,500).

Plenty of Beacons in U. S. A.

THERE are 1,355 rotating searchlights mounted on top of 50-foot steel towers at intervals of ten miles, and 225 code beacons in active service on airways in the United States. The lighting current for all the beacons would supply a city of 10,000.

The Latest Type Bleriot Transport



Front view of the Bleriot double-hull transport plane, a type that seems to be popular in Europe and in Italy as well as in France.

HERE we see the latest development of the Bleriot double-hull transport which has been under development for several years. This type of construction has several advantages among which is an unusual degree of visibility from the passenger cabins. The passengers, in the nose of the cabin, have an unobstructed view in front and to the side which is impossible with the usual form of tractor plane.

The two bodies are suspended from the cantilever monoplane wing, and at the rear, they form a dual support for the tail surfaces. This is an excellent construction for the support of the tail and at the same time, insures lateral rigidity. It will also be noted that four landing wheels are employed, two wheels in tandem under each cabin, thus reducing the load on the tail wheel in landing or taxiing on the ground.

A double powerplant is located at the center of and above the wing, one unit being a tractor while the other is a pusher. The pilot's cabin is located between the power plants from which he has an excellent range of vision.

Maybe You Can Tell Us What This Is

ON going through our files, the other day, we dug up the photograph shown below, which occasioned some violent discussions around the office. Then, some visitors tuned into the fray, and as they all differed we are presenting the ship for your suggestions.

It isn't a Jenny, though it looks somewhat like a JN. It might be a Canuck in spite of appearances—or anything else for that matter. The fuselage is a Jenny type, but the wings and markings don't look familiar. The radiator and the OX-5 are in the customary position.

Here's a good clear side view of the two-seater "Mystery Ship." D'ye know what it is or are you only guessing?

Cockeyed Controls

by ANGRY AVIATOR

JUST because a thing has been done in a certain way for twenty years or so does not make it right. I ask you why all automobiles are steered with the hands while we keep on pushing the sky chariots around with our feet?

Either the automobile is wrong, the airplane is wrong or I am wrong and something should be done about it if we expect automobile drivers to become aviators.

Time was when airplanes steered with a wheel and I never heard Beachey put up a holler about the system. In the old Curtiss biplanes we worked the ailerons by a shoulder yoke. Nowadays, we could substitute by tilting the wheel column sideways to get the same instinctive lateral control if we really wanted to interest automobile drivers in airplanes.

As a matter of fact there is absolutely no reason why automobile and airplane controls should not be uniform and plenty of reasons why they should be identical.

It would be interesting to know how many automobile accidents have been caused by a false instinctive action during that split-second when an aviator, driving an automobile, slapped right or left rudder with his foot in the vain endeavor to steer the car or, vice-versa.

How many airplane accidents have been caused by an automobilist learning to fly and instinctively trying to steer the ship with the stick or the wheel which are, unfortunately, not connected with the rudder.

The writer has no intention of going into the historical aspects of airplane control development, nor of placing the blame for this conflict in the methods of control of the two fastest and most generally used vehicles of transportation in use by us today.

The automobile came first, its control was standardized and millions of men, women and children have developed the instinctive reactions and muscular coordination required to steer in a certain way. The promotion of safety and the promotion of civilian flying points an accusing finger at this business of "cockeyed controls" and we have a special department of the Government whose business it is supposed to be to regulate aviation in the interests of safety.

We have regulations, specifications, laws and special requirements down to and including the last twist on every turnbuckle and the last thread of linen on each individual airplane, but the cockeyed controls still remain.

As a matter of cold clammy fact, I venture the statement that the authorities, Governmental and commercial, which really control the air are not interested in civilian flying and during

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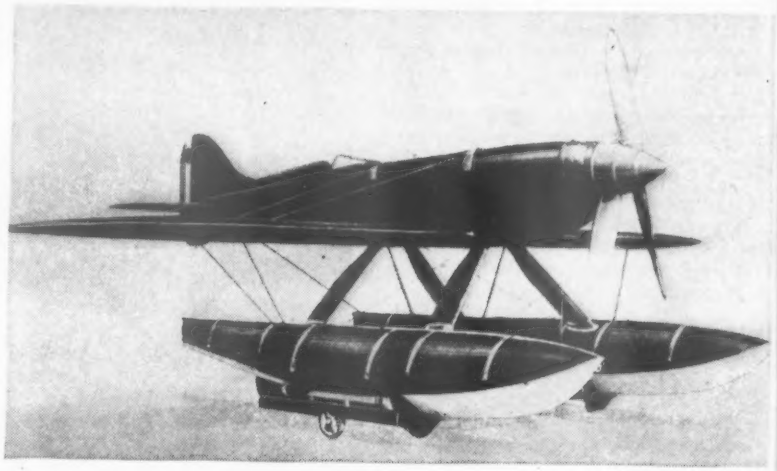
Another View of the World Record Seaplane



Three-quarters view of the record holding "Red Bullet" with its anti torque propeller drive and saddle radiators.

HERE is a detailed view of the "Red Bullet," recently flown in Italy at a speed greater than seven miles per minute. As explained in our last issue, this speed ship is driven by two Fiat engines which swing two independent propellers in opposite directions.

By this method of operating the 2,800 h.p. power plant, the torque is eliminated, but at the same time it is probable that there is some loss in efficiency caused by the use of tandem propellers. Recent press dispatches state that a further advance in speed has been attained so that the record now stands at 440 m.p.h., but this has not been confirmed.

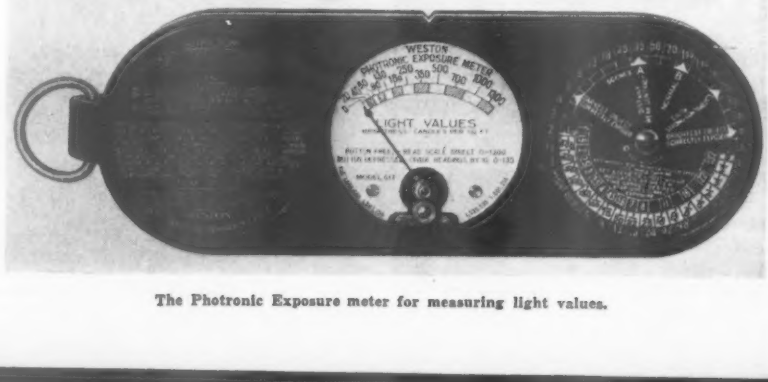
It will be noted from the saddle-bag type of radiators placed over the tops of the pontoons, that cooling is still one of the difficulties encountered at such high speeds, and it is doubtful whether the accredited speed of 423 m.p.h. could be maintained for any practicable length of time. It is also noticeable that there is a considerable amount of external bracing and that no attempt has been made at streamlining the chassis members running from the fuselage to the pontoons.

The engine arrangement is peculiar, the engines being arranged in tandem, this being made necessary because of the fuselage shape. As a matter of fact, the engines occupy practically all of the space forward of the cockpit. The horsepower required, by the way, checks up almost exactly with the power estimated in a previous issue of P. A. for this speed.

A New Exposure Meter Measures Light

LIGHT intensity measurement has been placed on the same basis as the measurement of amperes or volts by the Weston Photronic Photoelectric Cell. The latest use to which this remarkable electric eye has been put is a Universal Exposure Meter for photographic use, in which brightness measurements are taken directly from the scale of an instrument easily read by the layman. It can also be used for recording fog and cloud density.

It consists essentially of two parts, (1) an electrical instrument operating from two photronic Photoelectric Cells located in the back of the meter and (2) a simple, novel mechanical calculator for translating the brightness.



The Photronic Exposure meter for measuring light values.

Pusher Pursuit Planes Return

by FLETCHER PRATT

(Paris Correspondent of POPULAR AVIATION)

BACK in the early days of the World War, when the ancient FE's and Voisins hummed over the Western Front and nobody had yet thought of mounting a machine gun on an airplane, the pusher vied with the tractor for honors as the most popular type of plane. Then the Spads, Fokkers and SE's began to come along and the pusher was laid in its aeronautical grave as unsuitable for fighting purposes.

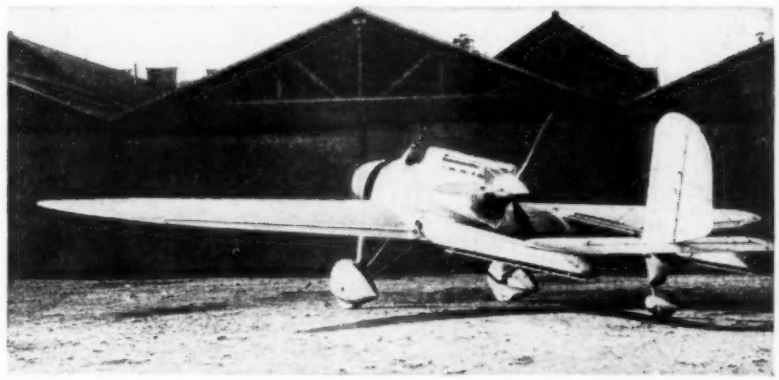
Now a French engineer, M. Jean Biche, in the service of the Hanriot firm, has suddenly resuscitated it in the design of a magnificent new pursuit ship which, though it has not had all of the "bugs" removed yet, already stands at the forefront of the new French pursuit craft as a machine of unequalled speed, climb and power and seems destined to restore the pusher fighter to its old rivalry with the tractor.

The new ship, which is called the Hanriot-Biche 110-C1, was originally designed with the idea of giving the pilot better visibility. This is a matter which has concerned designers of fighting craft all over the world and has led to all sorts of different solutions, such as the "camel's hump" design of the latest British fighters, the cut-away wings of the Polish pursuit craft, and the high-wing monoplanes of the latest Morane design.

The pusher, of course, eliminates the problem of giving the pilot better visibility around the enormous modern aviation motors by attacking it at its source and removing the motor entirely from the pilot's field of vision.

When the new Hanriot was wheeled out of her hangar for her preliminary trials, however, the aviators who went over her discovered that in addition to superior visibility, several other striking improvements had been made over the ordinary tractor pursuit craft. The new location of the motor not only gave her better balance and stability, but permitted a considerable reduction in the bracing, making a very light ship although maintaining the same strength as in the ordinary tractor pursuit craft.

With the weight at the rear of the pilot's seat, she not only turned out to be very fast, but extremely sensitive on the controls, as the control surfaces picked up the propeller slip-stream directly. Her light nose gave her wonderful climbing qualities and permittec a very low landing speed for a fast ship, as well as a quick take-off. The fire hazard was also sensibly diminished by placing the motor at the rear where



France experiments with the Hanriot pusher pursuit plane which possesses many advantages over the tractor type now commonly used. You no doubt remember that P. A. has always been a booster for the pusher type ship.

flame from the motor would touch no other part of the ship.

Again, the danger of the pilot being overcome by gas from the motor was altogether eliminated. Finally, and not unimportant in a military craft, the pilot is protected from attack in the rear by the whole mass of steel represented by the motor, a quantity of armor which makes it practically impossible for a bullet to reach him and in the meanwhile, his own machine guns have free play, having no propeller to shoot through.

Still another advantage appeared after the first trials, when, thanks to the great visibility of the new ship, it proved possible to transform the cockpit into an air-tight compartment and take away from the pilot, the clumsy mask and oxygen equipment necessary in other pursuit ships for flights at high altitudes.

The new ship is an all-metal craft of 44-foot wing spread. It has a single wing, the longerons of which run right through the center of the ship, with double-cantilever truss bracing throughout, making the wings very sturdy. At the center, the longerons are met by two other beams, which form the supports for the cockpit and motor. Outside the two latter beams carry the outrigger which supports the tail assembly. At each side of the pilot's seat and supported by the same beams which carry the center assembly, is a machine gun, firing straight ahead without synchronizing gear.

The motor is a Hispano Xbrs of 600 H.P. the standard motor for French pursuit ships. (Another motor may be substituted later, but as much of the equipment as possible was made standard with tractor pursuit ships to afford a basis for comparison). The motor is mounted directly behind the pilot and operates a three-bladed Ratier propeller, this propeller giving much better results than the usual two-blade type and is made possible by the fact that the machine-gun fire through the blades does not have to be considered. The oil radiator is underneath on the main axis of the ship.

The water radiator is a new invention. It is mounted at the extreme front of the plane in the position ordinarily occupied by the motor and is provided with a cowling like that given to motors. It is composed of concentric rings, and is controlled by an apparatus which the pilot can handle from his seat to cut down or increase the amount of air entering around the cowling and passing the radiator. The cooling is thus under the control of the pilot who can give his motor the maximum amount of cooling at low altitudes or cut down the cooling at high altitudes.

The landing gear at present installed on this original craft is of the ordinary French military type, with independent wheels and shock absorbers, again for purposes of comparison with the ordinary French military pursuit planes. As designed, and as to be built for future service, the Hanriot-Biche 110 will have a fully retractable landing gear. The tail landing gear is different; it has a tiny wheel provided with an oil-brake and braced to the horizontal rudder. It is controllable from the pilot's seat and adds considerably to his power of controlling the ground

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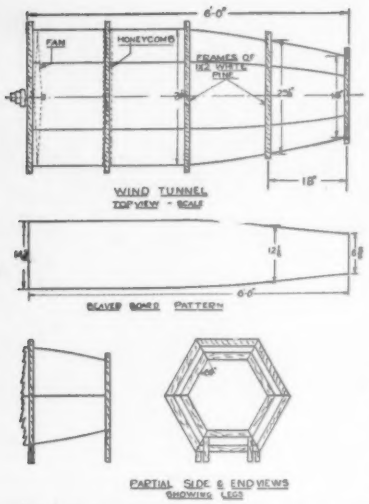
An Aeronautic Laboratory fo

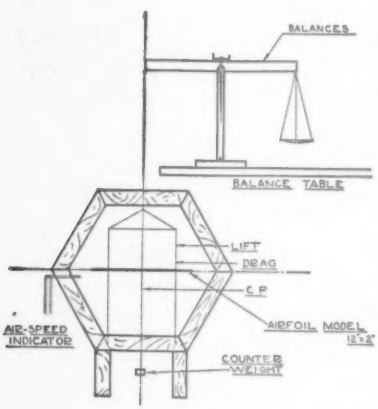
by

JOHN A. AMES

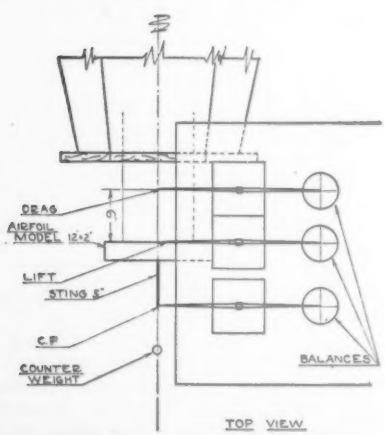
Experimental Aeronautical Engineer specializing in laboratory equipment.



The wind-tunnel proper, or "channel" that guides the airstream. This is easily built of wood.



End view of wind-tunnel with the balances and balance table in place. Note the location and suspension of the model.



Looking down upon the end of the tunnel and the three balances by which the air forces are measured.

EVERY aeronautical enthusiast knows the value of the wind-tunnel in the development of new airplanes and airships.

It is universally accepted as the best method for laboratory research and aerodynamic tests. Thousands of dollars are saved each year by means of the wind-tunnel, for the peculiarities of various airplane models are determined and corrected in the wind-tunnel previous to building the full size ship, thus effecting a large saving of money and also time—and often human life.

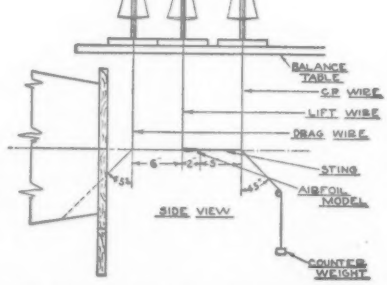
Most of us have seen wind tunnels or photographs of them and have wished that we could conduct tests and research similar to those conducted by the N. A. C. A., by the various universities and aircraft corporations but on a smaller scale. Such tests, as ordinarily could be made at home, were frequently behind an electric fan with little or no balance mechanism and without very successful results.

In this article, however, you will be shown how to make a wind tunnel with which you can get real results. With it, you will be able to make such tests as the determination of the lift and drag of airfoils and flat plates, the determination of the parasitic resistances offered by fuselages, airship hulls, floats, and multitudes of other interesting problems. The total cost of the materials for building this aerodynamic laboratory is less than ten dollars. This estimate, however, does not include the cost of the fan motor.

THE laboratory consists of two major parts: (1) the balance, to measure the forces, and (2) the tunnel itself to control the air flow. There are also the air speed indicator and the motor and pulleys.

The tunnel is constructed of wooden frames or forms made of 1 x 2 inch white pine.

These forms are hexagonal in shape and they are easily assembled by means of corrugated fasteners, obtainable at any hardware store. Five forms are required—three hexagons thirty inches in diameter, one twenty-five and one half inches and one eighteen inches in diameter. When cutting the wood for these frames, make the inner dimension of the sides of the frames exactly one-half the diameter.



Side view of the tunnel end and the three balances. Note the suspension of the model in the air-stream.

For example, on the eighteen inch frame six sides are cut, each exactly nine inches long on the inner dimension. In cutting these pieces, use a sixty degree triangle such as draftsmen use or a bevel gauge set at sixty degrees and try to keep the edges as true as possible. On the smaller frame legs are fastened by means of fasteners to keep the tunnel true on its axis.

Six pieces of beaver-board 14⅝ inches by six feet are then cut to the pattern shown in the drawing by means of a coping or jig saw. The frames are set up 18 inches apart and the beaver board pieces are nailed to them with No. 17¾ wire nails. Even though you take great pains in cutting your beaver board, you will probably find that the joints between the segments are not tight so it is advisable to seal the joints with unbleached muslin soaked in aircraft dope or very thin glue.

The honeycomb, though its construction may be tedious, is very simple. A number of strips of pasteboard tubing, about one inch in diameter, are cut into pieces two inches long. These pieces are then set up in regular row until a wall is formed. The honeycomb is located 18 inches from the fan end of the tunnel.

The fan is next constructed. This is a four bladed propeller made of birch. Make a full size pattern of its shape and when you obtain your wood at the lumber yard, have it cut at the mill. The cost of cutting will be comparatively small and it will save you a lot of time. By means of saw cuts, a chisel and a mallet, rough out the blanks nearly to the cross sectional shapes shown in full size. Then smooth them down with a spoke-shave and plane.

By cutting out the patterns, pasting them on cardboard and using them as templates, you will be certain that the pitch is true and that the lift surface is accurate. Don't be afraid to work your blank down thin enough as birch

ry for Only Ten Dollars

HOMEMADE wind tunnels are becoming of increasing interest among amateur experimenters, airplane builders and aeronautic students. They permit of extensive and fairly accurate experiments that shed much light on the performance of an airplane.

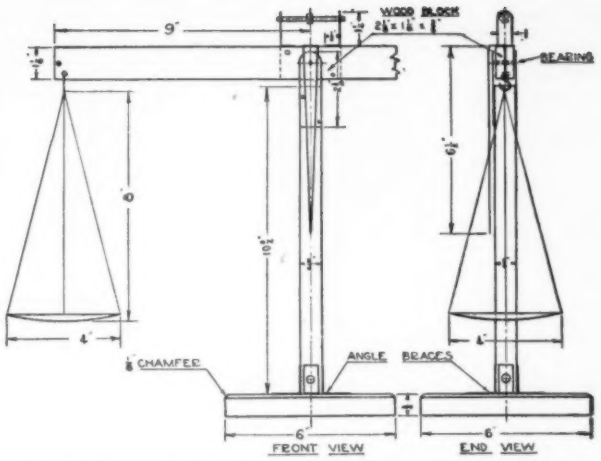
This simple and inexpensive tunnel described by the author in the following article, fills just such a need among amateurs and should therefore receive careful consideration by our readers.

is extremely hard and strong and any excess weight will only reduce the efficiency of your motor. The two separate propellers are then mortised, screwed together, sanded down and given two coats of varnish. The method of mounting the propeller will have to be worked out by yourself.

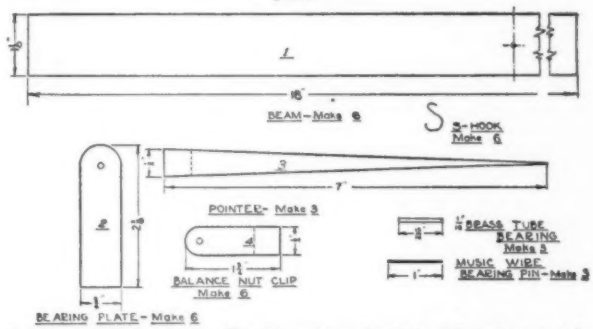
If you intend attaching the propeller to the motor drive shaft, you should make a stand on which the motor may rest so that the shaft center line is on the center line of the tunnel. If you have other uses for your motor, you will probably use a belt drive. The author used a polishing head, such as can be obtained at all mail-order houses for less than a dollar, as a bearing and stand for the propeller. This was mounted in a piece of two-by-four firmly nailed onto the last hexagonal form. A drive of round leather belting attaches the fan to the motor.

The most important question, perhaps, is what kind of a motor is needed. An ordinary one-fourth or one-third horsepower electric motor will give you a maximum air speed of about 35 to 40 miles per hour. The motor should have a speed of about 2000 revolutions per minute. You can probably obtain one second-hand from an old washing machine or similar electric appliance for five dollars or less. If you are lucky, you can obtain a variable speed motor. Otherwise you will have to control the speed of your fan by means of different size pulleys on the motor shaft and fan bearing.

The speed of the air passing out of the tunnel is determined by an air-speed indicator. This consists of two parts: the pitot static tube in the air flow and the manometer which registers the air speed. The pitot static tube is made of ¼ inch gas line tubing which can be obtained at any auto accessory store. Two pieces are required. These are bent to the proper shape, taking care not to crinkle the tubing at the ends. One tube, the dynamic tube, is left open and the other, the static tube, is sealed with a wooden streamlined plug. In the static tube, two rows of staggered holes are drilled with a No. 60 drill. In drilling the tubing, a little oil in the depression cut by the drill will allow the metal to be drilled more easily.



An assembled balance showing principal dimensions and arrangement of parts.



Details of balance parts. The dimensions should be followed accurately to insure accurate results in the tunnel experiments.

The manometer is made of glass tubing, at least one-fourth of an inch inside diameter. This is carefully heated in a flame and bent into a U-shape. It should be fastened on a flat board such as a drawing board and the scale in the drawing should be cut out and pasted on the board between the tubes. The tubing is filled with water colored with a drop of ink, to the zero mark.

The manometer is connected to the pitot static head with rubber tubing with one end of the glass tube fastened to the dynamic tube and the other end to the static tube. The pressure of the air at various speeds will cause the water to rise in the side of the manometer connected to the static tube. It is very important that the reading should be made from the bottom of the curvature of the water surface. Before conducting the tests, the water in the tube should be filled so that its level is at zero, when standing between tests, a considerable amount of liquid evaporates.

The wind tunnel proper being completed, we now start on the balance. We use a wire suspension balance as this is by far the most simple and easiest type to construct. The actual forces of lift, drag and center of pressure location are measured by three similar beam balances. First the beam balances are made, then the wires can be set up.

The base of the balance is a piece of 6" x 6" x ¾" white pine, with a ¼" chamfer. The post, also of ¾" x ¾" white pine, is 10¾ inches long and is fastened to the base by means of small angle irons obtained at any five-and-ten-cent store. Be sure that this post

DATA CHART

Airfoil Size _____ Tested by _____ Date _____ Velocity _____

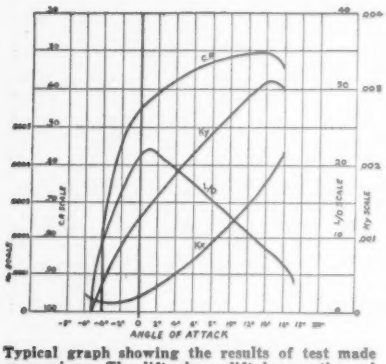
Angle of Incidence	Lift in Pounds	Drag in Pounds	Ky	Kx	L/D	Moment About leading edge	C. P. Position in % of Chord

Sample of typical data chart for recording the aerodynamic readings taken during tunnel tests. This gives the figures required for wing sections.

is perpendicular to the base. The bearing plates are fastened to the top of the post. These are cut of 20 gauge aluminum as shown in the drawing. These are screwed to the post with 5/8 inch nickel plated round head screws.

The beam is then made. This consists of two pieces of No. 20 gauge aluminum 18" x 1⅛". These pieces are riveted together at the ends and a block of white pine, ⅝" x 1⅛" x 2⅛", is placed in the exact center with 5/8 inch screws. Holes for the pans are then drilled. A hole is drilled for the ⅛ inch brass tube bearing and the tubing is carefully forced into the hole. Two balance nut clips are cut of No. 20 gauge aluminum and drilled as shown in the detail drawing.

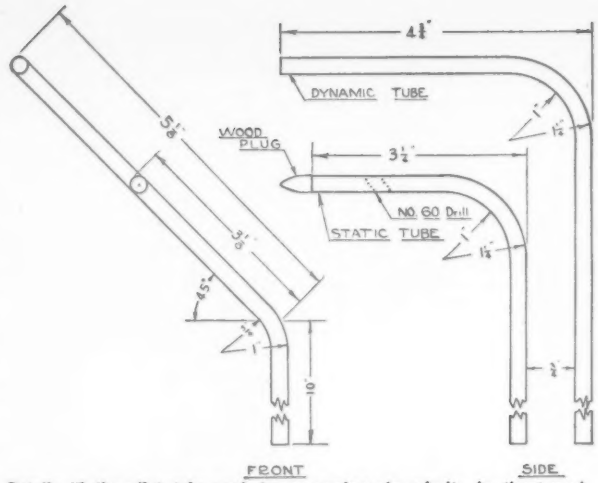
A 4/32" x 2" brass machine screw, with the head cut off, is mounted in the clips. The ends are peened over. A pointer is next cut from aluminum and mounted on the bearing block. A piece of No. 16 music wire is used as the bearing. Two S-hooks are also made of music wire. The pan is cut from aluminum, three holes equally spaced punched in it, and it is suspended from an S-hook.



Typical graph showing the results of test made on a wing. The lift, drag, lift-drag ratio and c. p. movement are plotted against the angle.

If you can afford to buy a set of weights from a chemical supply house, do so. If you cannot, go down to your corner drug store, borrow the druggist's scale and weights and make some. Use wire solder for the heavy ones and aluminum for the light ones. Be sure to convert the apothecaries weights into avoirdupois. Conversion tables may be found in chemistry books, dictionaries, and encyclopedias.

The only thing now remaining to be built is the suspension system. Make this of fine aluminum or tinned wire—the finer the better. It is very simple and can be constructed entirely from the drawing. In this tunnel, tests are made exclusively with 12" x 2" airfoil models. From points two inches from the end of the airfoil bring the two wires—one forward and the other upward. Remember the airfoil is mounted in an inverted position.

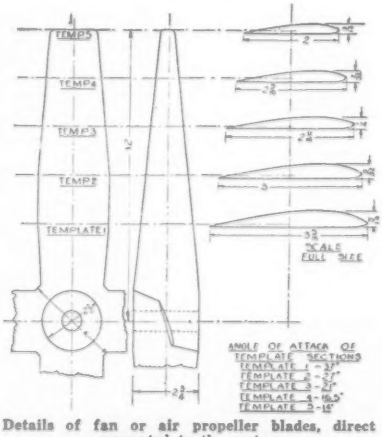


Details of the pilot tube used for measuring air velocity in the tunnel. This device consists of two tubes, the static and dynamic tubes.

The upward wires from either end meet and are led to a balance. These are the lift wires. The wires which are led forward meet wires going upward and are also led to a balance. These are the drag wires. The forward wires are bent down 45 degrees at this joint with the set of upward wires. They are carefully fastened to the base of the tunnel. The last wire is the center of pressure wire. This is fastened to a sting or small stick seven inches behind the leading edge. This wire is also led to a balance.

On this wire make little loops so that the angle of incidence may be controlled. A middle loop is made so that the airfoil is exactly parallel to the axis of the tunnel. Then make loops both above and below the original loops so that the displacement from the original position of the airfoil, measured at the end of the sting, is as follows:

minus or	plus	minus or	plus
for 1°	.14"	for 11°	1.33"
for 2°	.28"	for 12°	1.41"
for 3°	.37"	for 13°	1.60"
for 4°	.49"	for 14°	1.68"
for 5°	.63"	for 15°	1.82"
for 6°	.73"	for 16°	1.96"
for 7°	.85"	for 17°	2.13"
for 8°	.98"	for 18°	2.19"
for 9°	.98"	for 19°	2.31"
for 10°	1.26"	for 20°	2.38"



Details of fan or air propeller blades, direct connected to the motor.

An ideal balance table is a card table as the legs are wide enough to prevent any interference with the airflow. Make certain, however, that the table is not warped. Between the far pair of legs of the table, hang a small pulley. Through it lead a wire from the sting and hang a small counter weight on it. The tunnel is now finished, and we are ready to begin the tests.

First, we balance the weight of the airfoil and wires; then we switch on the motor and determine the velocity of the air flow. The airfoil is placed at zero degrees incidence and the balance system is then carefully balanced. The results are noted and placed on a chart as below. Tests are then made through varying angles of incidence by changing the loops on the center of pressure wire until the point of maximum lift and minimum drag are found.

The author advises that, in conjunction with these tests, the reader should obtain a good text book on simple aerodynamics, such as SIMPLIFIED AERODYNAMICS, by Klemin, or SIMPLE AERODYNAMICS AND THE AIRPLANE, by Monteith. Either of these books will greatly simplify the subject and aid in the plotting of curves. By applying the formulas:

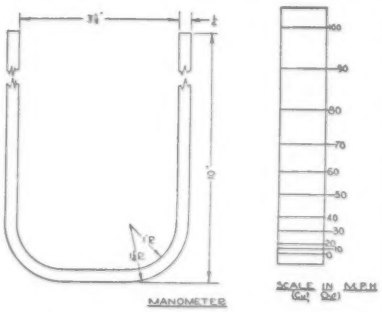
Lift (lbs.) = Ky (coefficient of lift) × Area (sq. ft.) X Velocity² (M.P.H.)

or $Ky = \frac{L}{AV^2}$

and Kx (coefficient of drag) $= \frac{D}{AV^2}$

one can determine the Ky and Kx of the airfoil and plot them as shown in the accompanying graph. The L/D curve, which is used to determine the efficiency of the airfoil, should be plotted. The L/D at any particular

(*Concluded on page* 206)



The manometer tube records the air velocity when connected to the pitot tube as shown by scale.

The Weak Link of Navigation

IN an address before the American Society of Mechanical Engineers, Lt-Commander Weems, U.S. Navy, told of the urgent need for a more efficient aircraft sextant.

"The sextant is the one remaining weak link in the chain of operations necessary for determining a position in the air," Commander Weems stated, and then he outlined the rapid progress made in aerial navigation made during the past six years.

The problem of developing a suitable sextant was laid before the A.S.M.E. as a challenge to their engineering ability. It is a necessary improvement and it will come. It will be fully as valuable as our present airway beacons, for a suitable sextant would place invariable celestial beacons at our command from which we can determine positions within a minute by methods already developed by Commander Weems and others.

As a hint as to how this requirement can be realized, Commander Weems told of the prizes offered by the British Admiralty between the years 1714 and 1728 for a more effective method of determining longitude at sea. A prize equivalent to $100,000 was offered for an instrument that could determine a position within 30 miles and yet this prize could easily be won at the present time by the use of a dollar Ingersoll watch. This shows how the accuracy of the timepiece has progressed since 1728.

POPULAR AVIATION has been so much impressed by the remarks of Commander Weems, that it wishes to call the attention of the airminded to the necessity of the improved sextant. P. A. therefore appeals to the commercial transport companies and others, as well as to the inventive geniuses of our land, to make this instrument come into actual being.

Surely, if the British Admiralty, in 1714-1728, could offer a prize of $100,000 for an instrument correct within 30 miles, our present day corporations could offer as much and more for an improved instrument correct within two miles, measuring from celestial bodies while under flight conditions.

The development of more effective means for the navigation of aircraft is in line with the policy of POPULAR AVIATION for it will prove to be a means for saving life and vastly improving air transportation schedules.

It is therefore proposed that commercially interested individuals and corporations donate substantial prizes for rewarding the inventor and research worker for their labors in this development. When such a prize is posted by reliable concerns, POPULAR AVIATION will take pleasure in conducting this contest which will be for the good of all.

The New Curtiss A-12 Attack Plane

Here we have the new Curtiss A-12 Attack plane in flight. Its general appearance is very similar to that of the first Curtiss attack plane A-8 which it succeeds. Greater power and wing slots have greatly improved the performance.

THE U. S. Army Air Corps has ordered 46 of the new D-12 attack planes, one of which is shown here. It is a late development of the A-8 attack plane which created a sensation some months ago.

This powerfully armed ship, sometimes referred to as the "Flying Fortress," is an all-metal two-seater that is said to have a top speed 60 m.p.h. higher than that of the standard Army Air Corps attack planes now in use. It is powered by a single 9-cylinder 700 h.p. Wright Cyclone engine which is partly responsible for the improved performance of this attack plane.

It has a tremendous offensive power as it carries five machine guns and a large bomb beneath the fuselage. Its purpose is "land strafing" or for making direct attacks against the ground troops of the enemy.

The Curtiss attack planes on this order by the U. S. Army Air Corps will be provided with Handley-Page lift slots and flaps. This gives the planes a wider speed range than any planes of this type now in use.

This order is the outcome of full scale service trials of slots and flaps by an entire squadron, the first squadron in the world to be equipped with fully slotted and flapped planes. The new arrangement insures not only a wide speed range but also gives improved lift and a steep climb after take-off.

For military planes, the ability to operate from small fields with heavy loads, to maneuver at low speed or when flying near the ceiling, without being forced to use high-lift, high-drag wing sections, is of the greatest importance. With a combination of slots and flaps, a high-speed, low-drag wing can be employed and its lift can be doubled. The slot, therefore, combines the advantages of high-lift and high-speed wing sections.

The accompanying chart, reproduced from the *Handley Page Bulletin*, shows the effect of employing wing slots and flaps as compared with standard low-lift and medium-lift wing sections. The R.A.F.-15 and the Clark "Y" section are made the basis of comparison. Measurements made on a well known type of monoplane shows this doubling effect on the lift very clearly. With the latest type of slot, it will be noted that the slot practically disappears in the nose of the section when in the neutral position so that there is no noticeable increase in the profile drag of the wing.

In active service during wartime, makeshift airdromes of small size and bounded by obstructions make the slots and flaps necessary for a quick take-off and steep climb out of the field. Using plain wings alone, heavily loaded craft would not be able to operate from such fields which would be forced upon them in a major war.

There is no question but what the lift slots and flaps are a most important contribution to military aviation, and if so highly effective with attack planes they should be even more desirable with heavy bombers operating from small fields. They could then challenge the pursuit ships.

EFFECTS OF LIFT SLOTS AND FLAPS ON PERFORMANCE

TYPE OF WING SECTION		MAX. LIFT COEFFICIENT	MIN. DRAG COEFFICIENT	SPEED RANGE RATIO	PER CENT IMPROVEMENT	PER CENT IMPROVEMENT	½ AT THIS LIFT
LOW LIFT SECTION (R.A.F. 6)		0.52 1.04	0.011	1.0			1.4
MEDIUM LIFT SECTION (CLARK Y)		1.40 1.80	0.029	1.0		18.1	1.0
MEDIUM LIFT SECTION AND SLOTTED FLAP (R.A.F. 28)		1.86 2.41	0.063	1.5	1.5	102 33 33	6.0
MEDIUM LIFT SECTION WITH FRONT SLOT AND SLOTTED FLAP (U.S.A. 27-A.S.)		2.0 2.98	0.060	2.00	60	30 82 86	9.0

Controllable Pitch Props on Transports

HOW controllable pitch propellers have boosted the performance of the new Boeing 247 transport planes is shown in figures just released by the Boeing Airplane Company.

With a gross weight of 13,100 pounds and with the new-type props, the following performance is shown for the ten-passenger, twin-Wasp carriers:

Cruising speed at 5,000 ft. (¾ power)	171 m.p.h.
Landing speed	59 m.p.h.
Takeoff	740 ft. in 15.2 seconds
Initial rate of climb	1320 f.p.m.
Climb at 5,000 ft.	950 f.p.m.
Climb at 10,000	625 f.p.m.
Climb in eleven minutes	10,000 ft.
Service ceiling	18,500 ft.
Absolute ceiling	20,200 ft.
Absolute ceiling on one engine	4,000 ft.
Cruising range	750 miles
Gross weight	13,100 lbs.
Empty weight	8, 340 lbs.
Payload	2,400 lbs.
Useful load (Including 273 gals of gasoline and 16 gals. of oil)	4,756 lbs.
Wing loading	15.64 lbs. sq. ft.
Power loading	11.91 lbs. h.p.

Hamilton Standard controllable pitch two-bladed propellers are being installed on the last forty-five of the seventy-five Boeing 247's under construction for United Air Lines and for sale to other air transport operators. Serving the airplane, much as a gear shift does an automobile, they make possible maximum power for takeoff, climb and cruising. The props are hydraulically operated from the pilot's compartment, being set for either low pitch or high pitch.

Unlawful To Repair Patented Parts

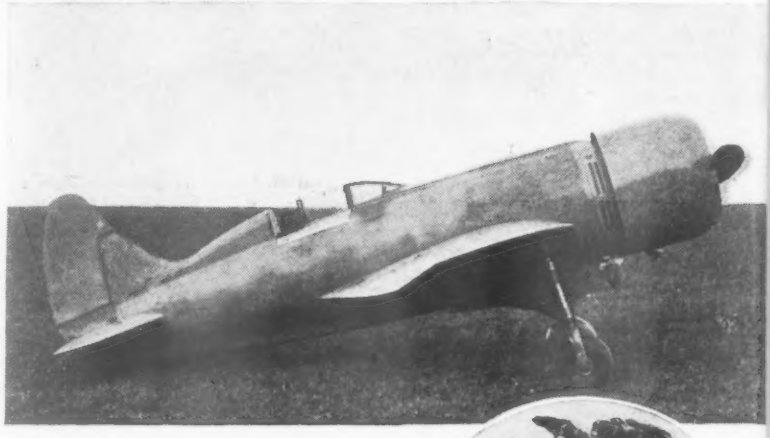
ACCORDING to the law, you as an owner or employee of an owner of an airplane have no legal right to make repairs on the portions of an airplane that are patented.

Perhaps yau *have* paid in full for the plane. Perhaps it *is* legally yours. But that makes no difference in the eyes of the law when it comes to repairing or replacing the *patented* parts.

You may break or completely destroy the patented parts if you feel like doing that. Ownership permits destruction but it does *not* permit *building up* of airplane parts that are protected by law.

Patents often apply only to a few specific parts. You may do whatever you wish to the *unpatented* parts, of course. But the patented portions must not be repaired by you or by anybody else without the permission of the patentee. Anybody furnishing parts for patented portions, or repairing those parts, who is not licensed by the patentee to do so is subject to damages for infringement.

The New Potez Baby Speedster



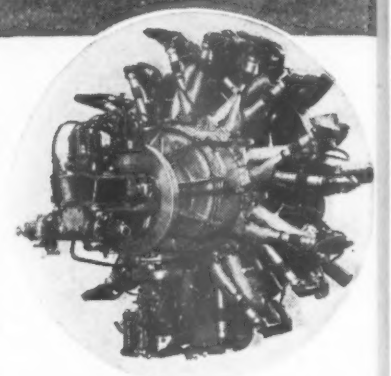
The Potez 310 h.p. Speedster.

GEORGES DETRE, one of the youngest French aviators, was named winner of the famous Deutsch de la Meurthe Cup this year, after having covered the 1200-mile course (non-stop) at an average speed of 193 miles an hour in his brand new Potez speedster. This is a single-seater with a specially designed Potez 310 H.P. motor, curiously reminiscent of the American Gee-Bee.

Raymond Delmotte, with a Caudron speed-plane finished second, with an average speed of 189½ m.p.h., while Lieut. Comper of the British army, on a ship of his own design, took the third prize. These three were the only ones of the seven competitors to finish the course. Gustave Lemoine, with another Potez, was leading the race at a speed of 213 m.p.h. when a gas line broke and overcome by fumes, he had to drop out.

The speed made by Detre, though not high for a racing machine, is extremely good when the size of the engine, one of the conditions imposed by the donor of the cup, is taken into consideration. It gives promise, that with a heavier power plant, the new Potez speeder will rival the best efforts on this side of the Atlantic. Under the conditions of the race, its size is limited to machines with 8 litres (1462 cu. in.) total piston displacement. This condition was met, in the case of the winner, with a specially-designed Potez motor, the 9-B star-shaped type of 310 h.p. with direct drive to the propeller. It weighs only 374 pounds and is fitted with a supercharger.

Detre's Potez ship is a new craft that represents a radical departure from the usual designs of the Potez factory, which specializes in seaplanes and high-wing monoplanes. It is a low-wing monoplane of all-wood construction, only the wing attachments and controls being in metal. The landing gear is fully retractable. Tests made by



The specially designed radial Potez engine used in the racer and rated at 310 h.p.

the Potez factory showed the interesting fact that the same type of machine with a non-retractable landing gear made 20 miles an hour less speed—a striking justification of the retractable landing gear.

The monocoque fuselage is built up of laminated wood layers, much after the fashion of the old American L.W.F. ships, and its complete success promises a revival of this procedure. All controls are mounted in the interior of the control surfaces, another new feature which has resulted in cutting down parasite resistance and increasing the efficiency of the machine.

Oil and gas tanks are placed just behind the motor in the front of the fuselage and are cut off in both directions by fireproof bulkheads. Both tanks have unusual ventilating arrangements, small tubes carrying air through them. The protective shield in front of the pilot's cockpit is detachable, coming away automatically to permit the pilot to bail out with his parachute in case of accident. Leading characteristics of the machine are as follows:

Length	17¾ feet
Wing Spread	21¾ feet
Height	6¾ feet
Total weight (full load)	1983 pounds
Maximum speed—228 m.p.h. (with Potez 310 H.P. motor)	

Navigating by Slide-Rule

by P. V. H. WEEMS
(Lieut. Commander, U. S. Navy, Retired)

Ingenious mechanical calculators simplify and expedite complicated navigational calculations that annoy the beginner and old hand alike.

JOHN DOE had cleaned up on the rising "new deal" market and on the strength of his newly acquired capital, has purchased a new two-seater long-range plane. This plane promises an adventure for John and his wife—something like the flight to the Orient by Col. and Mrs. Lindbergh, and he is impatient to get started.

Final plans were made. The destination was decided upon and all was ready except the special navigating instruments and the necessary data and means for navigating the plane. Then they found that there were a lot of problems for them to solve before they actually started their flight. It took them sometime to locate all of the sources of information, but this is the way they did it.

They first sent letters to the Hydrographic Office and to the U. S. Coast and Geodetic Survey, Washington, D. C., asking for a list of charts over the areas to be covered. They also asked the Weather Bureau, Washington, D. C., for information on the route. For flying over land, they used the land maps made by the Rand McNally Company, and were fortunate enough to have Mr. W. E. Johnson, Chief Cartographer of that company, give them helpful details. Foreign maps were obtained from such sources as the British War Department or the French Air Ministry.

They equipped their plane with up-to-date instruments, including a gyro horizon and horizontal horizon. Then came the problem of laying the courses on the maps and charts. They soon found that this was a tedious difficult mathematical problem until they discovered that much paper work and nervous energy could be saved by the use of slide-rule devices that solve the problems mechanically. Such devices, which can be purchased on the market, are of real assistance, and for the benefit of readers who have never worked navigation problems in this way, I will give the following instructions as I gave them to John Doe and his wife.

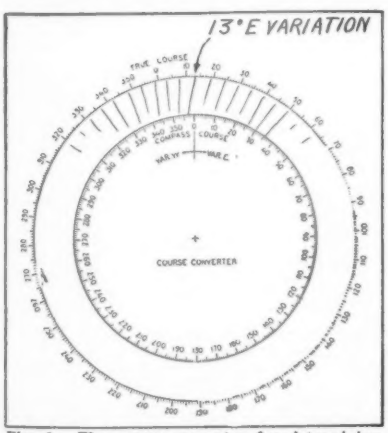


Fig. 1. The course converter for determining relations between the true course and compass course.

* * *

ASSUMING that you have a good aperiodic or other suitable compass mounted in your plane, but that its error has not been determined, try this one.

Obtain a "Dead Reckoner" and rotate the "Course Converter" disc to allow for the variation of the locality. Fig. 1 shows how the disc is set for 13 degrees easterly variation. The variation is found from a navigation map of the locality.

Now, head the plane true north and connect the north point of the outer circle with the reading of the compass marked on the inner circle. Next place the plane on a true heading of 30 degrees and note the compass reading, then connect 30 on outer circle with the point on the inner circle indicated by the compass head. Do the same thing for true headings 60, 90, 120, 150, etc., for each 30 degrees.

If the lines are more than five or ten degrees off the radial line, there is an excess of deviation which should be corrected by altering the position of the compass correctors as directed by the compass manufacturers.

Assuming the deviation not to be more than five or six degrees, which it will not be for the average well-located compass, then it is only necessary to fill in lines for every five degrees parallel to the lines drawn for every thirty degrees. We now have a fool-proof means for making course conversions.

It will be noted that nothing was said about making up a deviation card, about the magnetic course, etc. Well, if the variation is kept set for the location as shown by the chart, the course converter will make the entire conversion from compass course to true course or from true course to compass. To find the true course from the compass course, move from the compass course on the inner circle parallel to the deviation lines constructed and read the true course on the outer circle.

To find the compass course corresponding to a true course, reverse the operation and move from the outer to the inner circle. The sketch, Fig. 1, should make the operation clear.

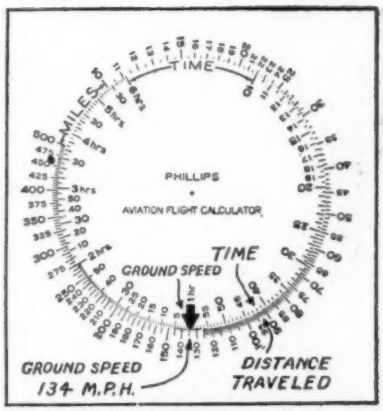


Fig. 2. Flight calculator for speed, time and distance.

A good part of the navigation to be done will be keeping track of the dead reckoning, such as speed-time-distance problems. How long should I hold this course at this speed to reach my destination? It took me 42 minutes to cover 93 miles, what speed am I making over the ground?

These and similar problems are difficult ones to compute by the "long-arm" method in a plane due to the fact that distance is given in decimal units while time is given in sexagesimal units. These and similar problems are readily solved by the Flight Calculator which is also on the Dead Reckoner with the Course Converter, together with convenient tables for computing the ground speed and drift when the force and direction of the wind are known.

Some simple means should be included for measuring drift. A good way to determine the ground speed is the careful timing of the plane as it passes over known land-marks and by using the time and distance on the Flight Calculator to get the ground speed.

Your plane should be fitted with the latest radio outfit, and you should be able to operate it in accordance with the Department of Commerce instructions. On established airways, you can "ride the beacon," while in some cases you may use a sending station as a "homing" station. Also, in case of emergency, you may send or receive messages.

Because there are no stations on the oceans, or on large areas of foreign countries, you cannot depend solely on

(Concluded on page 209)

Flying Feline Feels Furious

THOMAS CAT, who might some day have developed into a world famous aviator, suddenly abandoned his hopes of such a career when an airplane, formerly looked upon as a friendly acquaintance, turned upon Thomas and caused him to turn tail.

In making a routine inspection of the ships at an Army air field one day recently, the inspecting officer pointed at random to one of the planes, and ordered that its motor be started up. It started, alright—but with a sneeze and a sob—it just as suddenly died. It caught again and repeated the performance just as quickly.

Weird wails caused the officers present to cover up their ears, but the wails penetrated just the same, developing even into screeches. With a shaking finger, the inspecting officer nervously directed a mechanic to investigate and find the cause of the airplane's unusual behavior.

A soldier courageous, removed the engine cowling as a first step, and immediately hit the ground with a muddy splash. For from the carbureter airscoop, rose a hideous apparition of a tiger nine feet high which made a leap for the soldier's shoulder, jumped to the ground and fled. Other observers than the investigator, however, stated that the "thing" was but a very yellow, very bony and very much scared Tom Cat which had apparently taken cover against the cold.

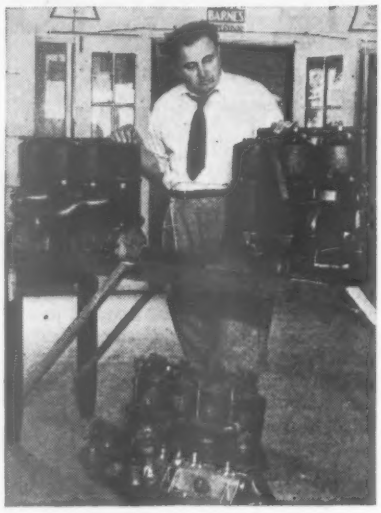
Their Sizes Contrast

STRANGE combinations are often found at the flying fields and here is just about as big a contrast in the matter of size as can be found anywhere.

Towering above Benny Howard's miniature racing plane "Mike" is the huge Martin bomber of the famous Jiggs squadron from Marsh Field, Calif. Benny Howard is taking a good look at the big fellow which is miles and miles larger than the tiny 1,200 pound Mike.

We wonder how many "Mikes" would make an army bomber?

Junk Man Starts Museum



Antiquities of aviation.

COLLECTING historical airplane engines is the hobby of Arrigo Balboni the flying junkman of Southern California. Balboni is in the aeronautical junk business, buying up hundreds of old airplanes which have outlived their usefulness, so that he has plenty of opportunity to indulge in his pet pastime.

In the picture, Balboni is shown with three aero engines that mark eras in aviation advancement. So important are these three antiques it is reported that the Smithsonian Institution of Washington is greatly interested in them and may add them to its already extensive collection.

At the right is a three-cylinder two-cycle Elbridge engine, built in 1907 and brought to California by Glenn Martin for the San Dominguez air meet in 1910. At the left is a four-cylinder two-cycle Elbridge used by Glenn Martin in establishing an altitude record. Both engines are valveless and are provided with copper water-jackets. On the floor is the grandpapa of the famous Curtiss OX-5, a four-cylinder engine built in 1908 by Glenn Curtiss. Note the familiar rockers and valve motion.

Plane Ride Pleases Baby

AN EASTERN lady landed in Los Angeles with her 13 months old child with high praise over the manner in which the officials of the air line handled the schedule of feeding for her baby. A telegram to the next stop arranged the child's daily menu. At every stop enroute, the officials had the milk and other articles for the baby's meal ready as the plane stopped. The mother said it was very difficult to travel with the baby on a train but that he was perfect on a plane and he did not get a bit tired or cross.

Progress of the L. A. A.

MEMBERS are being enrolled more rapidly this month than last month. Perhaps this is the effect of the approaching dead-line upon the stragglers, or perhaps President Roosevelt's economic campaign is getting in its effect. Anyhow, the coupons are rolling in faster as we go to press than they have been doing for some time.

In fact, just at this moment, we feel more confident as to the success of the organization than we have for some time. We feel as if the importance of the organization and its proposed activities was at least being more clearly appreciated than in the past by the fellows who were marking time by the wayside, waiting to see what the other fellow was going to do.

So when you receive this copy and read this notice, just send in your application for membership. It will just get in a hairs-breadth before the deadline, which as you probably know, is set for September First. If you act quickly, you will have just one chance to put this vitally important matter across the wire—so don't delay if you intend to help out.

You don't need a coupon, although this is convenient. Just put your name, address and the BUCK into an envelope, and don't forget to mail it to POPULAR AVIATION. If you want to build that lightplane or hop an experimental ship it will be necessary to remove certain state laws.

A New Test Method

MR. VAN VLIET has employed a novel rig for testing out wing-sections by mounting the specimen on a weighing mechanism attached to the front of an automobile. It is possible to use full size wing sections. This avoids many of the uncertainties connected with wind-tunnels.

The specimen wing section is driven through the air by an automobile.

A Flexible Wing is Successful

by JOHN D. VAN VLIET

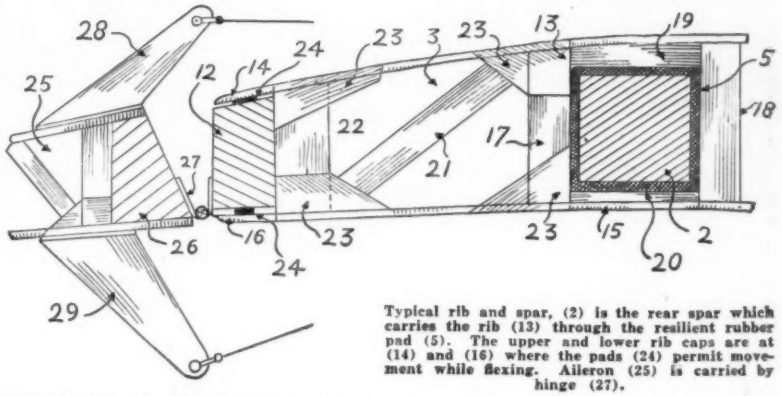
The author is the inventor of a bird-like flexible wing which has been proved efficient and stable in actual flight tests. This particular wing construction is highly flexible yet structurally safe and sound.

A STUDY of natural bird flight, more particularly soaring flight, reveals the outstanding fact that this mode of flying can only be associated with resiliently flexible wings.

That flexibility is essential to such bird flights has been proved by the fact that should the bird's wings be rendered rigid by applying a thin coat of varnish or cement to the flight wing feathers, the bird will no longer be able to soar and can make only uncertain progress by laboriously flapping its wings. The phenomenon of soaring flight, which has puzzled man for thousands of years, is therefore definitely associated with the flexibility of the feathers along the trailing edge of the bird's wings.

By applying the generally accepted theory of aerodynamics, soaring flight becomes an inexplicable reaction for these laws do not seem to fit the actual case. The well known fact that a Condor is able to soar indefinitely in any direction and at any altitude with the expenditure of only 1/270 horsepower, clearly refutes the supposition that soaring flight of birds is accomplished by utilizing ascending currents of air.

Dr. Samuel Pierpont Langley advanced the theory of "the internal work of the wind," based on his observations of soaring flight as accomplished by the turkey-buzzard, the hawk and the eagle. He concluded that soaring flight was due to air vortices or eddies impinging upon the flexible and elastic surfaces formed by the feather structure of the bird's wing. Further study of the subject was made by Prof. J. Bell Pettigrew, 1872, and by Jules Marey, 1873. The latter investigations were published in Marey's analysis, "Physiologie du Mouvement." All of these authorities prove that resilient flexibility of the wing is essential to economical flight and that a bird's wings, in addition to their lifting effect, also exert a forward tractive or pulling effect.

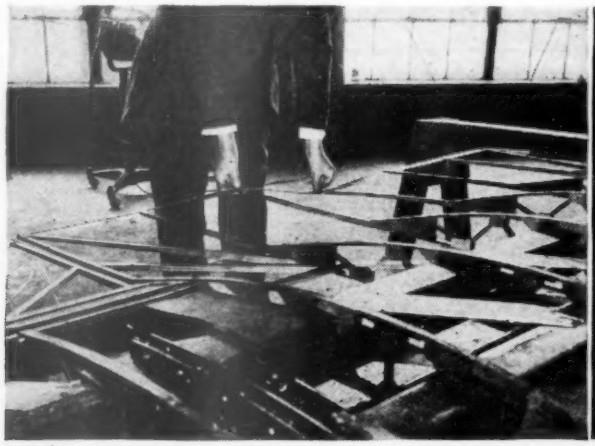


Typical rib and spar, (2) is the rear spar which carries the rib (13) through the resilient rubber pad (5). The upper and lower rib caps are at (14) and (16) where the pads (24) permit movement while flexing. Aileron (25) is carried by hinge (27).

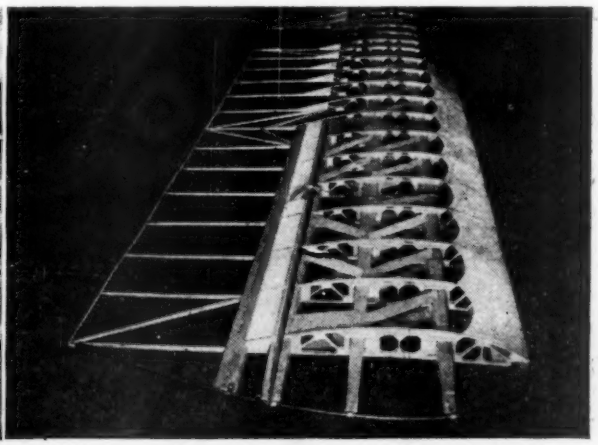
Attempts at applying the principles of the flexible bird wing to practice were made by many early experimenters, including the Wright Brothers, Prof. James Montgomery and Louis Bleriot. After some work, development was halted, largely because of structural difficulties experienced in making the flexible wings sufficiently strong. However, Louis Bleriot, in 1910, constructed the Bleriot No. 20, a monoplane having flexible trailing edges and warping wing tips. This machine proved remarkable for its automatic lateral stability. Somewhat later, came the Caudron monoplane also provided with a flexible trailing edge that proved highly successful.

Little more was done until A. Hallock, in 1914, proved mathematically that flexibility would diminish the stresses in the wing structure. Near the end of the war, an approach to wing flexibility was incorporated in the wing of the Breguet bombers, the flexibility in this case being approximated by a spring controlled aileron that ran the whole length of the trailing edge of the lower wing. This Brequet was admittedly a great advance over other bombers because of its remarkable degree of automatic stability.

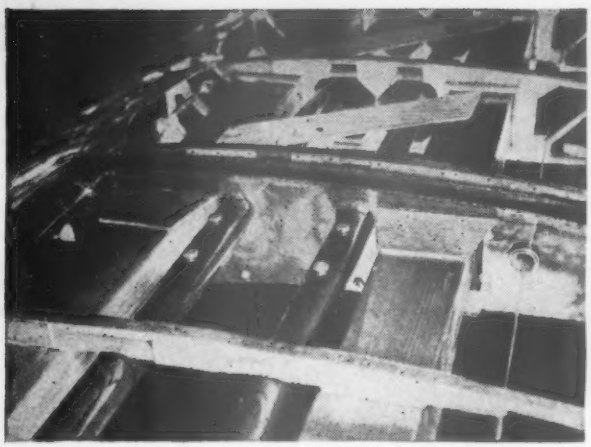
Then came the Christmas "Bullet," in 1919, with its flexible cantilever wing, a machine in which the flexibility more nearly approached the ideal soaring bird's wing than any of the other flexible type planes. The Christmas "Bullet" attained a considerable speed with comparatively little power and possessed remarkable lateral stability. The ultimate failure of the Christmas plane



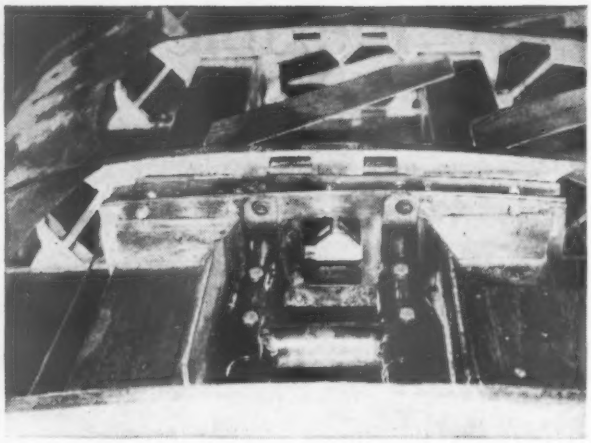
A simple demonstration showing the extreme flexibility of the trailing edge of the Van Vliet wing. This is attained without weakening the wing structure as will be seen from the detailed views.



The completely assembled flexible wing before covering, showing the ribs, spars and flexible trailing edge. It is mechanically simple and can be flown indefinitely without introducing fibre fatigue or damage to any of the parts.



Showing the flexible mounting of the spars in the center section of the flexible wing.



Closeup view of the secondary support of the flexible wing by which flexing is limited.

was due largely to structural defects in the wings which finally caused them to break.

Sometime afterwards, a plane with a laterally flexible wing, called the "Alula," was produced in England, this wing being likewise of the cantilever type. Successful flights were made but structural defects soon defeated the purpose of the machine as before. The inherently flexible wing of the pure cantilever type always involves two alternates; First, that of attaining flexibility at the expense of safety; Second, that of obtaining safety at the expense of flexibility.

Experiments were also made with flexible winged gliders in Germany where it is said that remarkable results were obtained. Among the tests made on scale models were the Zeise experiments made with wings shaped like those of a soaring bird. The Zeise wings had a thick entering edge like that of a bird with a thin flexible resilient trailing portion similar to that formed by the flight feathers of a soaring bird. The results obtained were remarkable. The well known Fokker wings also possess a limited flexibility.

Thus, in the early stages of development it was found that wings could be made to perform more efficiently and with greater stability when the rear spar was allowed to flex slightly so that the surfaces were thereby allowed to assume a slight helicoidal twist in flight and drop a few inches by their own weight when the machine was standing on the ground. The highly satisfactory performance of Fokker planes, extending over a period of many years has amply proved the advantage of allowing the wing to yield slightly to the air pressure instead of making them perfectly rigid.

The Autogiro is a more recent successful application of flexible wings since the blades of the rotor are allowed a great deal of freedom and are highly flexible in flight. The early Autogiros, built with rigid blades, were either unmanageable or refused to leave the ground at all.

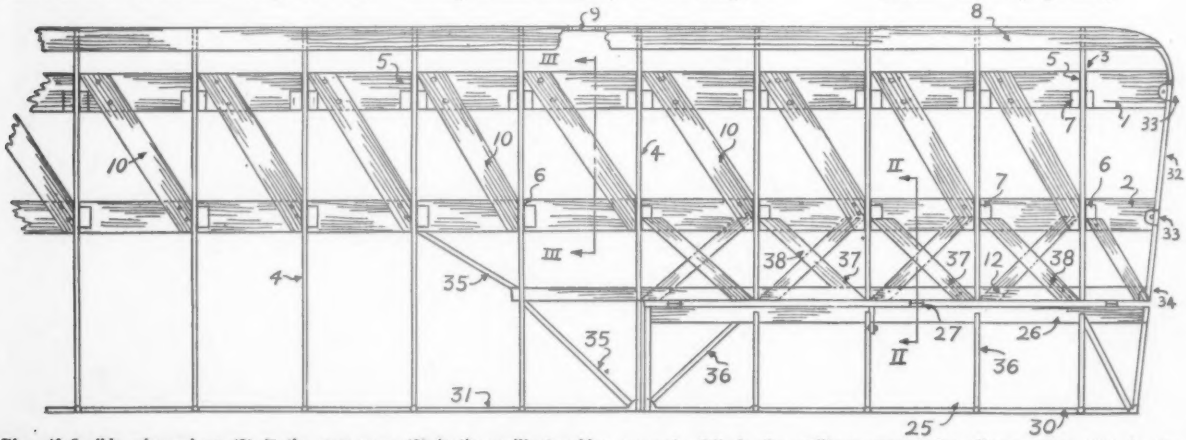
* * *

HESE problems have been solved satisfactorily in the flexible winged Dereimer plane, designed by the author, which incorporates the features set forth in U. S. Patent 1,768,386. This wing simulates the wing action of a soaring bird, described below, without in any way endangering the structural strength and integrity of the wing. Its construction is shown by the accompanying illustrations.

The wing of a soaring bird can be structurally divided into three main groups; the bones, the muscles and tendons and the feathers. The bones provide support for the muscles and feathers while the muscular system operates the wings in flapping flight and acts as a tension member when the wings are outstretched. Mention should be made, however, of a particular tendon which is of major importance during soaring flight, namely, the elastic "vinculum," located some distance back of the muscles of the forearm and pinion.

The quills of the flight feathers are fastened to the muscles of the forearm and pinion and from there pass through the elastic vinculum, so that each flight feather has two supports. The front support is comparatively rigid while the rear support (vinculum) is yielding and resilient. The flight feathers pass to the rear of the arm, the primary feathers being carried by the pinion while the secondary and tertiary feathers are carried by the forearm and upper arm respectively.

(*Continued on page* 198)



Plan of flexible wing where (2) is the rear spar, (5) is the resilient rubber support. (24) is the resilient support for aileron spars, (25) is the aileron, (14) is upper cap-strip, (16) is lower cap-strip and (27) is aileron hinge.

Aerobatics a la Cow Pasture

by ALFRED CELLIER

Harry, commander of Squadron OX-5, deserts his military caste and becomes enamored of the aerial circus and barnstorming line of business with his pal playing the role of goat—as per usual.

"LOOPIN' jelly fish!" says Harry and leaves his mouth open.

"Hmm!" I says.

We had just seen the one interestin' stunt that the air circus had pulled during the whole afternoon. A guy had looped with a girl parked out on the top wing. The rest of the business was hot dogs, peanuts and a lot of blah.

As we was bouncin' home in my fliv Harry says, "That was a blame good stunt."

"Yeah," I says, "it was O. K. to watch."

"It really wasn't anything dangerous," he goes on, "that gal couldn't have fell of. Centrifugal force. When a loop is done correct, the pressure on the seat of your pants remains the same."

"I'm glad you told me," I says, "for when I done what you called a loop with you the pressure was all on the safety belt."

"That was because I did variations," said Harry.

"Variations was all you done," I answer. "If it hadn't been for your variations in settin' a airplane on the ground we would still have your OX5 to flop around in. The book says you are supposed to land a airplane on the wheels, not all over."

"Shut up!" says Harry. "I think that subject has done been discussed. Besides I told my old man if he would buy me a new crate we wouldn't play at any more wartime flyin'."

"What of it," I says, "he ain't bought you no airplane."

"He might," says Harry.

"He's got too much sense," I answer.

"Which ain't neither here nor there," says Harry. "There's money in it."

"In what?" I asks.

"In a air circus," says Harry. "What else was we talkin' about? Look at all the money the yaps in towns around here are waitin' to shell out to see a stunt like that gal on the wing. I say that was a blame good stunt."

"I admit it," I says, "why argue."

"We are goin' in the air circus business," says Harry.

"O. K. by me," I answer. "The only drawback I see is that first, you ain't got no airplane, and second, there's no gals around here with the correct kind of weakness in the head to be parkin' on a top wing."

"I don't need no gal," says Harry, "I got you."

"Like thunder," I answer.

"It ain't dangerous."

"We must have started a loop then but there ain't no way for me to tell, for there I was out in the air all by myself."

"No, not for the guy sittin' back in the ship."

"Even if you get throwed off, you got a chute."

"A chute wouldn't do much good if you was already scared to death. You know what I think of chute jumpers."

"You'll do it won't you?" asks Harry.

"Why argue," I says, " you ain't got no airplane. Get out, I wanta go home, I'm hungry."

We was by this time parked in front of Harry's house.

"You'll do it," insists Harry, not makin' a move.

"Sure," I says, " I'll hang on the landin' gear with my tail. Get outa here. I wanta go home and eat."

He does and I does.

Well, my usual luck, which ain't any, holds out. The very next afternoon Harry's papa goes down to the port and buys that second hand crate which Harry has been yelling his head off about. Harry comes by my house that night and brags for an hour about what a fine new airplane he has got.

Harry stops and whispers, "Report for the dawn patrol in the morning, Lieutenant."

"I thought the war was over," I says.

"Just a slippage of speech," says Harry. "The air circus starts practice at daylight tomorrw. Be present on the dot. I'll borrow a chute for you."

With that he gets gone.

I see trouble loomin' up pretty black but am so pleased over gettin' to fly with Harry again that I try to forget it.

I say to myself, "that bird ain't gonna get me messed up in no more foolishness. No sir! Besides, he won't get up in the morning at no daylight."

I go to bed.

The next morning I was pounding my ear peaceful like when all of a sudden a roar cuts loose, Whir-r-r-r! Like a big buzz saw cuttin' the house in two. I jumps out of bed and runs out on the balcony and there is Harry, divin' the house. I guess he's kinda mad because when I wave at him and he sees I ain't got on no clothes he takes a extra dive at me that nearly pulls the shingles off the roof. I decide I better get down to the port before Harry comes back and somebody gets sore. That boy wasn't foolin' when he said daylight.

"She flies swell," greets Harry with dignity as I steam in.

"That's nice," I says, cold like.

"Here's your chute."

"I don't want it."

"Put 'er on!"

I does.

"Now we'll fly out where they ain't nothin' but farms and try a few odds and ends. Get in."

We taxies down to the end of the field and Harry says:

"When I wiggle the wings you climb out on top and we'll do a few easy ones."

"I ain't gonna do it," I says. "This trick crate might fold up."

Harry opens the motor and yells, "you got a chute ain't you?"

We takes off.

Pretty soon we was way out over the country and Harry signals by wiggling the wings. I pretend I don't notice anything and sit tight like I was admirin' the scenery. Harry wiggles a few more times and then cuts the motor.

"All right son, climb out."

"I ain't gonna do it," I says.

"Go on," he yells, " there ain't nobody around here."

"I am," says I, "and I wanta stay."

"I believe you're scairt," yells Harry.

"I am," says I.

"You gonna let a mere girl back you out?" he asks. "That guy in the circus didn't have to yell his head off every time he got a stunt done. Far be it from me to have it said that I got a pal what is a sissy."

I guess he knows he's got me so he opens up, climbs a little and then wiggles the wings.

Well, I start to crawl out. There ain't a way in the world for me to tell

you how scared I am. Boy! I am about petrified, and it seemed like it took me an hour to make a move. After about a week I gets up on that top wing and I bet I have left dents every place I touched that airplane.

Harry cuts the motor and I grab on in a strangle hold.

"All set?" he yells.

I was so scared I had forgot that there was supposed to be some stunts added to all this misery, so I blasts back.

"I'm comin' down. This is enough practice for today."

Harry didn't want his practicin' spoiled so he opens up with a roar and down we goes in a dive. We must have started a loop then but there ain't no way for me to tell, for there I was out in the air all by myself.

I must have done some fast thinkin' then for I remember how pleased I was once, when my feet flopped around between me and the ground. I knew then that I must still be all together. I grabbed onto that release ring and give her a jerk that like to have thrown my arm out of socket and then, Bang! I bet every bone I got changed places when that chute opened.

It was pretty nice for a while then. I was just floatin' there in the air swayin' a little bit with Harry circling around watching.

Then before I knew it, I was almost on the ground. Down below me is a big field with a lot of cows and things in it running around, and a farm house over at one side. I didn't get time to do much figurin' when, wham! I hits plenty hard. I thought I had been movin' along easy but the ground just all of a sudden reaches up and slaps me one and did those cows scatter!

That blame chute was still filled with air so there I went, bouncing along from rock to rock, tearin' off the seat of my pants and most of the hide that was under 'em. At last I got her stopped and as I see a guy comin' runnin' I gets ready to strut with dignity in front of the yokel population, even if I ain't got no seat in my pants. I changes my mind though on gettin' a closer look at the welcoming committee.

This bird has got a pitchfork in his hand and he looks like he wants action, so I get up steam immediate. Imagine him being sore and trying to be a harpooner just because some of his silly cows got scairt and tore through some fences.

When Harry sees me land he goes on back to the airport and when he sets down some silly dope what's hangin' around asks him.

"Where's your pal?"

"Oh," says Harry, "he seen some gal back at a farm house and wouldn't come back with me."

That made me kinda sore, Harry's sayin' that, with me back there gettin' chased around a cow pasture by a guy with whiskers and a pitch fork, with no seat in the back of my pants.

Operating Lightplane Engines

by MANLEY MILLS

EVERY lightplane builder looks forward to the happy day when the ship is finished and he is ready to install the engine.

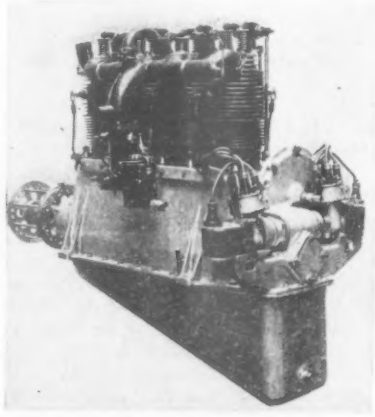
Whether it happens to be a shiny new one direct from the factory, or a good second-hand one picked up for a bargain, there are certain points to be observed in making the installation that are necessary for a satisfactory job.

When uncrating and handling the engine before placing it in the plane or on the test-stand, the thought to bear uppermost in mind is that the engine is a delicate and unfortunately expensive piece of mechanism. It's not just a hunk of cast iron or something. The more you appreciate this fact, the less chance there will be of breakage. With an air-cooled engine, the fins are easily broken through carelessness.

There are lots of ways to uncrate a new engine but only one *right* way. The instruction book you get with the engine will describe that way. Read it carefully and follow the directions exactly. Don't make the mistake of just putting the book away without reading it or to refer to it only when spare parts are needed. Often, such spare parts would not have been needed if the instruction book had been followed in the first place.

Sometimes, it is desirable to place the engine on a test-stand first for minor adjustments and running-in, especially if it is a second-hand one which may need a little tinkering before it will turn up properly. It goes without saying that such a test-stand must be sturdy enough to withstand vibration of the engine without shaking apart and must be securely anchored to the ground. Oak is probably the most satisfactory material for the stand.

Inspect all nuts to see if they are properly tightened. Clean the magneto breaker points to remove any oil that



An airgooled 4-cylinder engine of the type commonly used for lightplanes.

Lightplane engine parts are delicate and require careful handling to avoid serious damage while making an installation.

may have leaked in during shipment. Check the valve tappet clearance before running the engine. If it is a new one, the instruction book will specify the proper settings. As a general rule, engines in the lightplane class should have tappet clearances as follows: Intake valves, .008 of an inch. Exhaust valves, .012 of an inch. The exact clearance, of course, will depend wholly on the size of your engine and its operating temperature; the higher the temperature, the greater should be the clearance. When the valve tappets for a certain cylinder are checked, that piston should be at the firing point.

In mounting the engine on its bearers in the plane, it should be hoisted up with a block-and-tackle or crane. Have another fellow or two help you swing it into position, using caution to prevent injury to the motor or yourself. The mounting-bolt holes should not be bored until the plane is balanced by sliding the engine back or forth an inch or two in the usual way. The mounting bolts themselves should be of nickel-steel, at least a quarter of an inch in diameter. Most radial or opposed-type engines do not use a parallel-beam mount, but require a ring supported by a few short tubes. Or in some cases, the ring is not employed, the tubes being bolted directly to lugs on the engine. With such an arrangement, it's not so easy to balance the plane by moving the engine. It is usually more satisfactory to move the wing back or forward.

The proper cowling of an engine doesn't usually receive as much attention as it should. Especially is this true when the ship is of the home-builder's own design, or when he uses an engine other than the type specified

(*Concluded on page* 194)

Practical Lessons in Aviation

by JOHN B. RATHBUN

This is the first lesson, in a series of lessons, dealing with the basic principles of the airplane and aviation. In articles to come, we will take up the subjects of wings, engines, performance and many other basic factors.

ALL of us, though we seldom realize the fact, live at the bottom of an ocean that is many miles in depth. We are, therefore, continually immersed in a fluid, which even as light and intangible as it may sometimes seem to be, is still an actual fluid.

This mighty ocean, that envelops the entire earth, is called the "atmosphere" while the fluid itself is known as "air". It presses in every direction because of its weight, and although it is not sufficiently dense to support our bodies directly in the same sense that marine creatures are suspended in water, yet the air is heavy enough to contribute some degree of buoyancy.

The air has weight, it has the ability to flow and eddy like any fluid, and is capable of establishing pressure on surfaces by its impact while in motion.

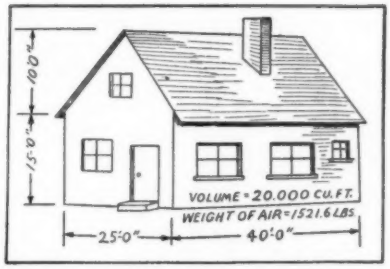
WEIGHT AND DENSITY OF AIR

AIR has a very definite weight, but this is not apparent to us for the reason that we are immersed in it so completely that it balances equally on all surfaces. At sea-level, a cubic foot of "standard air" weighs 0.07651 pound or approximately 1¼ ounce. This is not much compared to the 62.4 pounds weight of a cubic foot of water, but the weight is sufficient to enable us to fly if we apply the proper forces to it through the medium of gas bags, wings or revolving inclined surfaces.

One way of bringing the weight of air into an understandable form is to compute the weight of air contained within the small cottage illustrated here. This small building has a volume of 20,000 cubic feet, which when filled with air weighing 0.07651 pound per cubic foot, gives us the astonishing total weight of 1,521.6 pounds, or more than three-quarters of a ton!

Just at this point we wish to call your attention to the meaning of the word "density." The density of any substance, whether a gas like air, a liquid like water or a solid like iron, is its weight per cubic foot.

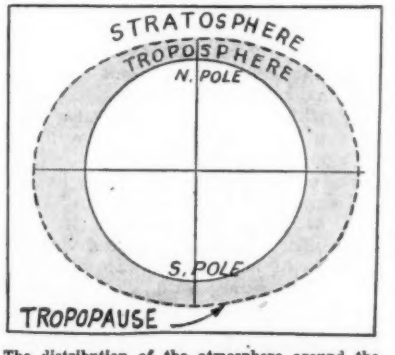
By applying pressure to the air, it is possible to crowd many cubic feet of air into a vessel having a capacity of only one cubic foot, hence it is evident that when a big volume of air is forced into the space formerly occupied by a cubic foot of standard air, that the compressed air will weigh just that many times more. For example, if five cubic feet of standard air are compressed into one cubic foot of space, then the weight of the cubic foot of compressed air will be: 5 x 0.07651= 0.38255 pound. Water and iron are only very slightly compressible.



Believe it or not, the air contained within this house weighs 1,521.6 pounds! Air has weight.

SUMMARY OF IMPORTANT FACTS

1. **Standard air at sea-level weighs 0.07651 pound per cubic foot.**
2. **Density of a substance is its weight in pounds per cubic foot.**
3. **The density of air depends upon the pressure, the temperature and the amount of moisture.**
4. **The density of air increases with the pressure and decreases with an increasing temperature.**
5. **The density of air is less at high altitudes than at sea-level.**
6. **Elevations are measured from sea-level.**
7. **The average normal air pressure at sea-level is 760 millimeters of mercury (29.92 inches), 14.7 pounds per square inch or 2117 pounds per square foot.**
8. **The barometer is an instrument for measuring atmospheric pressures.**
9. **The barometric pressure is affected by weather conditions and will range from 28 to 32 inches at sea-level.**
10. **A falling barometer generally indicates the approach of bad weather or high winds.**
11. **The temperature of the atmosphere decreases at the rate of 3° F. per 1,000 feet altitude up to 36,000 feet where the temperature is -67° F.**
12. **The lower part of the atmosphere in which an increasing altitude is accompanied by a decreasing temperature is called the "troposphere."**
13. **The atmosphere above the troposphere is known as the "stratosphere" while the narrow boundary between the two is the "tropopause."**
14. **The capacity of air for moisture is increased by heating, and the weight of the moisture per cubic foot of air is known as the "absolute humidity."**
15. **The relative humidity is the ratio of the actual moisture to the amount of moisture required for saturation at that temperature.**



The distribution of the atmosphere around the earth. The temperature decreases with an increased altitude within the shaded portion or troposphere.

On the other hand, if the pressure is reduced by applying a suction or vacuum pump to the cubic foot box, and if a part of the air is removed by the pump, then it is evident that the density will be reduced for the simple reason that some of the weight has been removed. Air in a partial vacuum weighs much less than air at atmospheric pressure.

The density of standard air is measured at sea-level, or under corresponding conditions. At any other height, or under varying weather conditions, the pressure changes and with these changes come corresponding variations in the density of the air. Therefore, the standard density of 0.07651 pounds per cubic foot is only true at sea level, or under equivalent sea-level conditions.

ATMOSPHERIC PRESSURE

IT HAS been calculated that the atmosphere extends for a height of about 50 miles around the earth, hence the weight of every cubic foot of this air presses down upon the earth's surface. The atmospheric pressure, therefore, is simply due to the weight of a column of air approximately 50 miles in height.

At sea-level, this pressure amounts to approximately 14.7 pounds per square inch or 2117 pounds on every square foot. This, of course, is the pressure referred to a vacuum. Just as an example, the "absolute pressure" on the floor of the cottage shown here is equal to: 25 x 40 x 2117=2,117,000 pounds! This would be the actual pressure or weight indicated by scales if a vacuum was created beneath the floor.

Now, from what has been said, it is apparent that the air pressure and density will vary at different points above sea-level. If we are at a height of one mile above sea-level, then there will be a lesser weight of air above us, the pressure will be correspondingly less and the density will be reduced. If we rise to five miles above sea-level, then there will be still less air above us with a further reduction in the pressure and density. This variation of pressure and density with altitude greatly affects flight performance at high altitudes.

Let us take an imaginary column of air, one inch square and extending from sea-level to an altitude of 36,000 feet. At 18,000 feet, the pressure is just about half the pressure at sea-level while at 36,000 feet, the air-

pressure is reduced to one-quarter its value at sea-level.

Air pressure measurements are made by means of a delicate pressure gauge known as a "barometer" which compares the atmospheric pressure at any point with vacuum or "zero pressure." There are a number of methods of expressing atmospheric or "barometric pressure," aside from pounds per square inch or per square foot as previously explained, and we will now investigate the pressure units which are so commonly used in aeronautics.

The first of the barometers was the mercury barometer or mercury manometer shown by Fig. 4. This is a very simple yet accurate instrument consisting of a dish of mercury and a glass tube, the tube being closed at the upper end with the lower open end immersed in the mercury basin. The tube is first filled with mercury and then the open end is placed under the mercury in the dish. The weight of the mercury pulls it down for a short distance, leaving a vacuum in the upper sealed end of the tube.

As indicated by the arrows, the air presses down on the mercury in the dish with a pressure corresponding to the atmospheric pressure at that moment and it is this pressure that supports the mercury in the tube at a definite height. If the pressure is reduced by any means, then the mercury column drops correspondingly because the reduced pressure can no longer support such a high and heavy column of mercury.

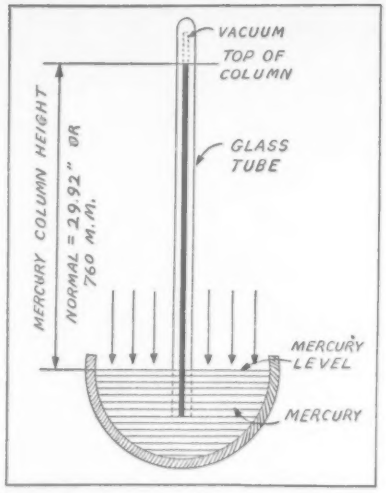
If the pressure increases, then more of the mercury is forced up into the tube so that the mercury column is higher than before. It is evident, therefore, that the pressure of the atmosphere can be expressed by giving it in terms of the mercury column height that it can support.

At the normal sea-level pressure, the air will support a column of mercury 760 millimeters high, which in the English system of measurement is equal to 29.92 inches of mercury. Years ago, when the metric system was not in common use in this country, the normal height of the mercury was given as 30.00 inches.

It is due to the use of the old mercury manometer that pressure readings are given in inches of mercury or millimeters of mercury, even though the mercury type has been discarded in the airplane because of its awkward size and shape, drawbacks which prohibit its use as a portable instrument.

It has been superseded by the "aneroid" barometer which is a true pressure gauge of compact portable form.

But altitude is not the only factor that controls the pressure and density of air. Weather conditions producing circulation of the air or variations in temperature and moisture all combine to make the matter more complicated than previously explained. For example, a barometer located at sea-level may show a variation of as much as four inches of mercury due to varying weather conditions at that point.



Measuring air pressure by the mercury barometer. Under normal conditions at sea level, the air pushes the mercury up in the tube 29.92 inches.

For this reason, the barometer has long been used as a weather forecaster because certain variations in pressure correspond with various changes in weather conditions.

At sea-level, the "high" is about 32 inches while the "low" is about 28 inches of mercury. A region above the normal pressure (above 30 inches) is called an "anti-cyclone" while regions under the low pressures (less than 30 inches) are "cyclones." However, these terms have nothing to do with "tornadoes" which are often incorrectly called "cyclones."

Generally speaking, a descending or "falling" mercury column indicates the approach of bad weather, while a rising column indicates clearer or good weather. The weather bureaus sometimes give the atmospheric pressure in terms of "millibars," the millibar being the equivalent of 0.02953 inch of mercury.

HEAT AND EXPANSION

NEXT in importance to atmospheric pressure is the effect of heat upon the atmosphere which influences all of the other properties. First of all, heat expands free air and by increasing its volume the density is correspondingly reduced. Warm air is therefore lighter than cool air and local temperature differences produce air flow in the form of both horizontal and vertical air currents. These vertical "thermal" currents make it possible to soar with gliders or sailplanes and have a pronounced effect upon flight with powered airplanes.

For example, when the air is heated and expanded, airplanes take off and land at higher speeds than in cold dense air. Irregularly spaced vertical currents of heated air cause "bumps" and rough riding with airplanes.

Atmospheric temperature gradually decreases with an increase in altitude up to 36,000 feet above sea-level. The rate of temperature decrease is about 3° F. for every 1,000 feet of altitude until a height of 36,000 feet is reached at which the temperature is approximately -67° F. From 40,000 feet to 50,000 feet, the temperature increases slightly with further ascent. The lower regions of the atmosphere, where the temperature decreases with ascent, is called the "*troposphere*." The constant temperature regions above this point are called the "*stratosphere*," while the imaginary boundary between the two regions is the "*tropopause*."

At the poles, the stratosphere is approximately six miles (32,000 feet) above sea-level which increases to 11 miles (58,000 feet) above the equator. At 50,000 feet altitude, which is about the height of the stratosphere over the Central States, the air pressure is reduced to 5.65 inches of mercury (about 400 pounds per square foot) while the density is reduced to 0.011 pound per cubic foot.

The limits of the troposphere in which we live, is therefore determined by temperature effect. Above the troposphere the temperature no longer declines with increasing altitude. It is a region of either intense glaring sunlight or dense deep shadows with no half lights. The air is so "thin" that diffusion of light is impossible.

EFFECT OF MOISTURE

SO FAR, we have only mentioned pure dry air for the sake of simplicity and have neglected the moisture that is always present in free atmospheric air. Air in nature always contains a certain amount of water vapor that has been absorbed from rivers, lakes and damp earth over which the air has passed, the amount of water vapor depending upon the temperature and other conditions. The amount of moisture in the air is known as "humidity" and is measurable in grains per cubic foot of air.

Only a fixed amount of moisture can be absorbed by a given volume of air at a given temperature, and when the air has as much moisture as it can hold, it is said to be "saturated." The higher the temperature, the higher the saturation point and the greater will be the possible amount of water vapor in the air. Reducing the temperature of saturated air results in the rejection of some of the moisture in the form of dew.

Now, in order to express the relative amount of moisture contained in the air at any one time, we have the unit —"relative humidity." The relative humidity is the ratio of the amount of moisture actually contained in the air to the amount of moisture required for saturating the air at that particular temperature. Thus, if the relative humidity happens to be 55 percent, it indicates that the air is holding 55 percent of the amount of moisture required for saturating the air at that temperature.

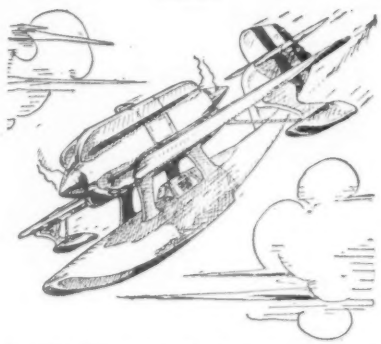
The humidity is measured by instruments known as "hygrometers" or "psychrometers." The nature of these instruments will be taken up in future lessons.

END.

Dream Ships by our Dreamers

Here we have an open forum for the ideas of our readers who have been bitten by the designing bug. All are interesting, some are good, some are fair and some are—

Here's a Boat What am a Boat

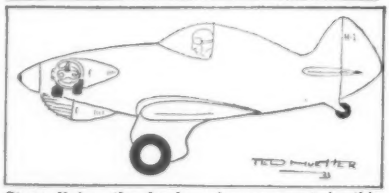


A mighty fine action sketch of the super-powered flying boat which should have plenty of speed.

ALTAMONT COLE, Centerdale, R. I., has sketched an original type of racing flying boat which should sure speed along under the influence of its two Packard "X" engines rated at 1,500 h.p. per each. We're willing to bet that it will take off, any way and mebbe beat the Italian record.

It would be a whole lot better if the designer's dreams had suggested a means of getting rid of the two wing-tip floats, which most certainly would consume a lot of power. He specifies a 24 foot wing span, self-supporting, while the hull assists the lifting effect to no inconsiderable extent.

Dreaming of Lightplanes

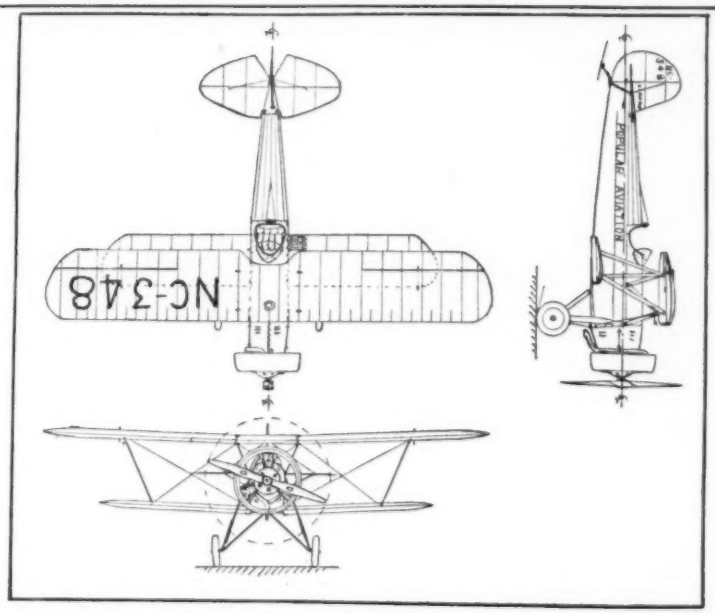


Streamlining the fuselage is uppermost in this designer's mind. Not a bad idea in general though it can be improved in detail.

MANY nights of dreaming, leading to three baskets of waste-paper, gave the results pictured here by T. A. Huetter, Jr., Spokane, Wash. This lightplane, when through with pylon polishing, could probably be used for sub-stratospheric adventures because the pilot is hermetically sealed in his cockpit. The kicker is a 2-cylinder 35 h.p. Aeronca with everything else on the same scale. Methinks that the pilot, unless a 300 pounder, should be moved back to balance the engine.

This idea of carrying out the full streamlining through the body is excellent and calls to mind the general outlines of the late lamented XP-936.

The Marathon Type S-1



This is a neat design for a light biplane, which though of a conventional type is interesting and well worth studying.

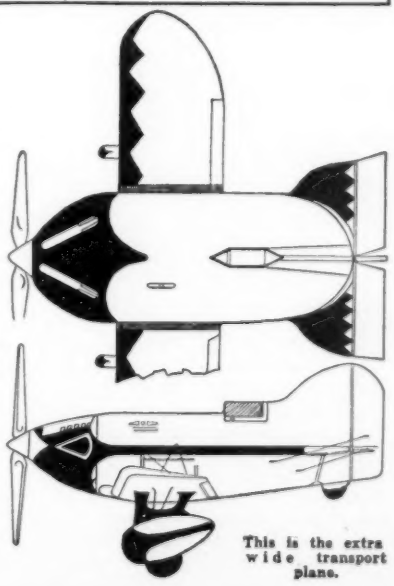
ARTHUR F. SCHWARTZ, Kiawo, Kan., bounced off the pillows and sketched the lightplane dictated by his dreams. This light biplane, according to the designer, is built around a 40-50 h.p. engine of some sort. Moderate flying speed and large safety factors are the leading features of this ship which is not at all bad looking. Our dreamer is 17 years of age and has aspirations toward becoming an aeronautical engineer. Well, good luck to you, Arthur, you are making a start toward your goal.

This Wide Fuselage Gives Plenty of Room

THIS ship will surprise you if you turn from the side view to the plan view and note the unusual width of the body or cabin This has its purpose, however, in spite of its unusual appearance.

From the beginning, the cry of passengers and transport operators has been for wider seats and wider aisle space, and here they have their prayer answered in the most emphatic manner. As a matter of fact, the projected horizontal area of the body is so great that the designer should give some thought toward making it an efficient lifting surface.

The resistance will be greater than the present type transport offers, but at the same time it should not be prohibitive. It is at least greater than the double-hulled Bleriots or Macchis, and as a matter of fact, the profile resistance should be somewhat less for the same cubic contents.



This is the extra wide transport plane.

Jack Vilas — Early Bird

by ED NELSON

GATHER in close ladies and gentlemen. You model builders and pilots can come along too. Oh! my gosh, now look what I've done, the wing-walker and 'chute jumper want to butt in.

Well, let's make it open house—I should have known when I am about to introduce such an outstanding member of the Early Birds, that the world at large would want to meet him. That's one faux pas you can charge to me.

First let me tell you folks what happened back in 1913. Mr. Glenn Curtiss was sitting in his office in Hammondsport, one day, busy as usual, figuring out something new in aviation, when in walked a spindle-legged homely little punk about eighteen or nineteen who announced that he wanted to buy a flying-boat.

Glenn yawned and said, "that's nice, but run along now for I'm busy." Did the boy run? He did not, so Glenn asked him, "Did you ever see a flying boat?" "No sir, I have not, but I want to buy one anyway."

Well, to make a long story short and not keep you up too late, the deal was made, the boy learned to fly and was awarded flying boat license No. 6. He has since carried hundreds of people on their first trip in the air and among one of his outstanding achievements was his trip across Lake Michigan in 1914. This was the longest non-stop water hop made to that time and the first time that an airplane ever flew across one of the Great Lakes.

During the World War he was stationed at the Great Lakes training school in charge of flying and since the War he has continued to fly and has given much to aviation in many ways. He is at this time, with the Pyle National Company, the people that make lighting equipment for airports and ships.

Now folks, I take great pleasure in presenting to you that pal of mine, this Early Bird that I have known for so many years that I have flown with and whose flying I greatly admire. Ladies and Gentlemen, I want you to meet—Hey, what the dickens is your name anyway? Oh! yes—Jack Vilas, folks.

The Australians Take 'em Young

FLYING Cadets in the Royal Australian Air Force are between ages of 18 to 22 years. In American Army Air Corps the ages are 20 to 27. Graduated Australian Cadets are given four years active duty in Australian Air Force or five years in Royal (Imperial) Air Force for service in England and the East. Graduated cadets in our Army Air Corps get only 15 or 16 months active duty before reverting to inactive status.

The Aero-Sportswomen

by JOAN THOMAS

MISS RUTH R. NICHOLS presided over the aviation round table conference at the annual convention of the National Federation of Business and Professional Women's Clubs, held in Chicago.

It is a significant fact that this was the first time that Aviation has been recognized as a profession and included in the agenda of an important conference where representatives of all the recognized professions for women were gathered together.

Miss Nichols presented the results of a very thorough and comprehensive survey of women in the industry and it brought out many interesting points.

"There are many women employed in the aviation industry," she said, "but these are principally in clerical, stenographic and hostess positions. And although 50 of them are licensed pilots, many of whom have had years of experience and are qualified to hold any sort of a position, there are no women who are now employed in a piloting capacity."

At the end of her report Miss Nichols made several very definite recommendations. First, since there are so few opportunities at present, she suggested that those who want to take up flying in the next year or so should do it purely for sport!

On the other hand, with her usual far-sighted and pioneering spirit, she wants to see a regular employment bureau established so that the aviation industry can get definite information regarding the qualifications of pilots wanting jobs. She has been working for the past year on an idea of getting an endowment for a "Women's Aeronautic Foundation" and she suggests

Mary Pickford, right, congratulates Mae Haizlip, famous woman flyer after the races.

the possibility of organizing an all women's airline, manufacturing company or airport as evidence of what women can do and to absorb the present unemployed pilots.

"With these thoughts in mind," she said in conclusion, "let us not be aggressive feminists, antagonizing the aviation industry which has done such a splendid job during its short span of life; but rather let us show by our disciplined daily routine of life, a spirit of constructive cooperation."

* * *

THE fourth annual meeting of the Women's National Aeronautical Association held in Chicago, July 5-7, was terminated by a banquet at which Ruth Nichols was the principal speaker.

There were several other famous guests present, Benny Griffin, of trans-

(*Continued on page* 196)

The W. N. A. A. committee meeting Ruth Nichols at the Chicago Municipal Airport. Left to right: Mrs. Clayton Patterson, Mary Dowd, Margaret Green, Mary Hempel, Mrs. McQueen, Mrs. Clark Stearns, Ruth Nichols, Mrs. Green, president; Mrs. Blackmore.

Radio on the Eastern Air Transport

THE Eastern Air Transport's radio system is composed of eleven ground stations and the equipment on planes. In addition, there are short-wave receivers located at Augusta, Savannah, Macon, Daytona and Raleigh. Information of interest to these points is broadcast to them by the nearest of the ground stations. This includes dispatches, weather reports and other important "rush" information.

The eleven ground stations are equipped with a transmitter layout, which is controlled by a switching arrangement conveniently located on the operator's desk to facilitate the rapid change from voice to telegraphy. The ground stations are equipped with two receivers, one of which is kept tuned to a fixed wave-length on which the planes transmit.

With this system in use, should a plane call the ground station while the operator is engaged in handling messages by radio-telegraphy on another circuit, then the calling plane will be heard through the other receiver connected to a loud speaker. Should this occur, the plane operator immediately interrupts the code operator, changes his transmitter back to the voice wavelength and is in conversation with the pilot in less time than it takes to tell about it.

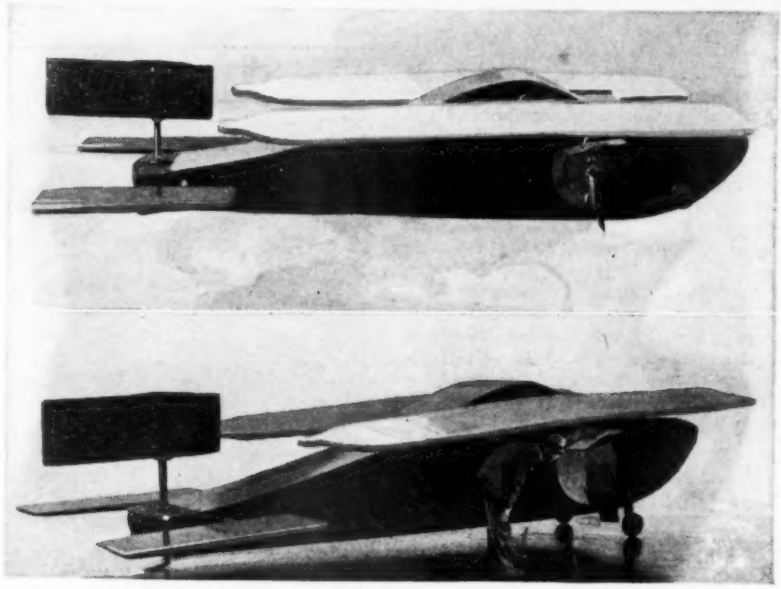
The radio equipment on the planes of the Eastern Air Transport can be used for both the transmission and reception of code as well as radio-telephony. A large number of the pilots are men who learned radio code while in service during the World War.

The Department of Commerce operates a system of beams (or beacons) over the routes travelled by commercial airlines. This radio-beacon system is used mostly by mail pilots flying at night and sometimes in unfavorable weather, but can be utilized by passenger plane pilots as well. By listening to this beacon a pilot is able to determine if he is off course, and if off, is able to ascertain which way he is out of line by noting characteristics of the beam. These beacon stations interrupt the beam at intervals and broadcast weather by voice on the same wave length.

The ability to use both voice and the "dit-dit-daa" of the radio code is of exceptional merit in the Southern States where the tremendous bursts of static occasionally render voice transmission, useless. Voice is the quicker and can be more universally applied, however, when the static permits.

The Eastern Air Transport has found its radio system to be a very valuable unit, both from the standpoint of planes communicating with ground stations, approaching planes and exchanging weather reports. In addition rush dispatches, weather and other important messages are speedily handled between the ground stations.

Brooks' Eagle-Wing Air Treader



Views of the Brooks craft on the ground and in flight with the landing gear retracted. A reaction type plane.

C. E. BROOKS has invented a revolutionary plane, which is based upon the flight of a bird, for which he claims many advantages over the standard or conventional plane of today. He calls it the Eagle-Winged Air Treader.

The principal innovation is the abolishment of the propeller principle. In place of the usual modern propeller, Brooks has employed what he calls vanes. There are two of these on each side of the fuselage.

The propulsion system of his plane is rotary, planetary, concentric and eccentric. By simply operating a hand-lever to adjust the vanes in any position desired, the air-wash may be directed to any point in a circle around the center shaft, either upward, downward, forward, or backward. The speed and force of the air-wash is truly tremendous, so great in fact that a wooden model, with a small electric like motor installed will compel the model to actually rise and start to fly away.

Again, by means of a hand-lever, the wings may be adjusted simultaneously at like angles, or separately at varying angles for different purposes in flight.

The propeller vanes are simultaneously made adjustable by similar means. For a perfect landing at low speeds the motor speed is to be regulated and the vanes adjusted, say 12 feet above the ground, to throw the air-wash forward and downward on the ground. In this way the air rebounds against the up-tilted wings and fuselage, permitting the ship to descend slowly and lightly as a bird.

The chief purpose of the vane is to move the ship forward in the air and upon the water. The air treading vane in the upper position is reaching forward and pulling while the lower one is kicking backward and pushing. He likens this action to a person swimming or walking. Again, two adjustable vanes are driven by planetary gears and revolve backward on their own axis in a direction opposite to that of the propellers and center shaft. The gear reduction is on a basis of 2 to 1, while the angles of the vanes relative to each other are constantly changing.

When the ship flies forward, the wings are parallel with the fuselage and ground. When the ship lands, the adjustable wings are tilted upward, an action similar to an eagle, when it descends. Further, the two propellers, with the two air treading vanes attached, are thereby adjusted to direct the air-wash under and against the wings to check the momentum of the ship. For ascending the same wing position is employed as for landing.

How are the wings and propeller vanes adjusted, you may ask? Through the power plant by means of hand levers. Therefore, with the aid of the motor, it is possible to make a quick, abrupt take-off, also a safe and slow landing.

The ship's fuselage is enclosed so the ship may land on either water, snow or land. There are ground wheels attached for landing on the earth.

Instead of the motor being in the very nose of the plane, as in standard planes, it may be and is placed at the very bottom of the fuselage, directly in front of the pilot. This factor has many advantages, noteworthy being the lack of tendency of Brooks' plane to go into a direct nose-dive.

The Air Lines in Summer

CONSIDER the fortunate air traveler these days when the thermometer hovers near the century mark.

While his earthbound brothers swelter in the blistering sun rays, the air traveler demands that his pilot turn on the heater. Temperatures around 100 on the ground are accompanied by thermometer readings of 50 to 60 in the cabins of the big multimotor transports. Pilots, seeking maximum comfort for their passengers, fly at altitudes ranging from 10,000 to 14,000 feet.

Several instances have already been reported this summer where heaters were necessary to maintain comfort aloft. On one trip, Pilot Franklin Young of Transcontinental & Western Air was flying east to New York with six passengers. From an altitude of 12,000 feet, near St. Louis, he radioed that passengers had requested the heaters be turned on. Temperature aloft was 55 degrees; on the ground it was 98.

The high altitude flying, aside from providing for passenger comfort, gives the travelers a taste of the type of travel which will be in vogue a few years hence. Many of the new planes already in construction have been designed to take advantage of the higher altitudes with their smoother and more regular wind conditions.

Cierva Receives Guggenheim Medal

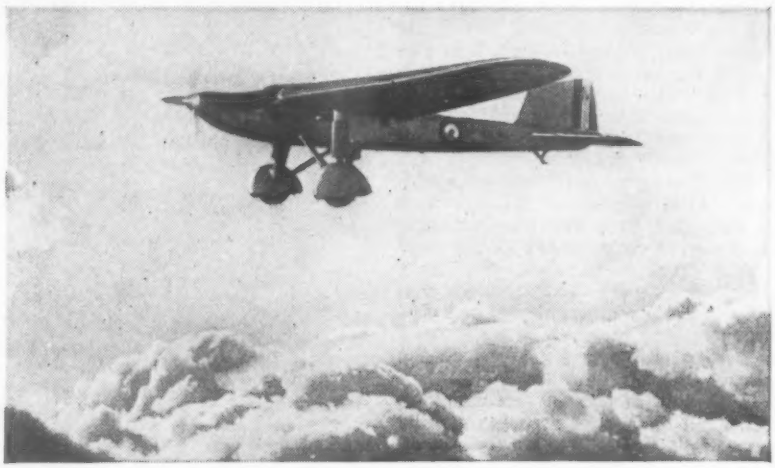
DON JUAN DE LA CIERVA, inventor of the Autogiro, was awarded the Guggenheim medal for the outstanding achievement in aviation during 1932.

This medal was presented to Cierva at the Century of Progress exhibition in Chicago on Engineers' Day. The ceremony was attended by the leading engineers of the United States who applauded this courageous inventor for his success with the direct-lift type of machine. The photo shows Cierva receving the medal from Edwin E. Aldrin, chairman of the Guggenheim Board of Award.

Cierva, on the left, receives the Guggenheim achievement medal from Edwin E. Aldrin.

QUESTION AND ANSWER DEPARTMENT

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION's Technical Staff.



The English long distance bomber on its record breaking flight. This flight, which was considerably over 5,000 miles, demonstrates the possibility of long distance passenger routes.

QUESTION:—Karl L. Baxter, Minneapolis, Minn. *How is the impact load on a landing gear shock-absorber calculated?*

Answer:—THE energy in foot-pounds rather than the force unit is employed. The energy (E) is: $E=WV^2/64.4$. The velocity (V) is: $V=3+0.1V'$, where (V') is the stalling speed in feet per second.

* * *

QUESTION:—Al Schmidt, Harrisburgh, Pa. *How much heat is lost through the radiator of a water-cooled engine? Does this loss reduce the power of the engine?*

Answer:—FROM 25 to 35 percent. of the total heat in the gasoline is dissipated to the air through the radiator. This, of course, is the representative of the amount of power lost, and is one of the reasons for the present inefficiency of the gasoline type of engine.

* * *

QUESTION:—J. J. Hammond, Cedar Rapids, Ia. *Is a tapered wing better than the rectangular type?*

Answer:—THE tapered wing has several advantages. (1) Better efficiency or lift-drag ratio, (2) Better distribution of the air load and (3) The ailerons are more effective with a tapered wing.

* * *

QUESTION:—J. A. Koehler, Fostoria, Ohio. *Please publish a picture of the British long range ship that recently broke the World's long distance record.*

Answer:—WE have printed above the best photo that we have of the Fairey-Napier plane that broke the World's distance resord.

QUESTION:—Harry Lucas, Bath, Me. *Why is aviation gasoline different than that used for automobiles?*

Answer:—THE aviation engine is designed for a higher compression pressure than the average auto engine and again, it must vaporize more freely at low temperatures because the aviation engine is started at a lower cranking speed.

* * *

QUESTION:—M. F. Desmond, Toronto, Ont., Canada. *Is there much danger on approaching a thunder-cloud with an airplane? Has an airplane ever been struck by lightning?*

Answer:—YES. In the first place, there are violent air currents along the storm front which can easily dismember an airplane, there is usually a tremendous precipitation of hail and then, there is always danger of the plane being struck by lightning. A number of planes have been struck by lightning, some of which were wrecked while others pulled through the experience in safety.

* * *

QUESTION:—Dell Summers, Duluth, Minn. *With full throttle, does a propeller turn over faster in flight than when standing still on the ground? If so, why?*

Answer:—WHEN the ship is standing on the ground, more power is absorbed by the propeller than in the air, hence it turns more slowly. In this case, the propeller moves a greater mass of air (100 percent slipstream) than when the blades are cutting through the air in flight, because the blade angle is greater in respect to still air than when passing through translational air.

(*Concluded on page* 204)

What the Industry is Doing

Latest bulletins from the airplane, engine, equipment manufacturers and dealers boiled down into a nutshell. Contributions to this department are invited.

SPORTPLANE builders will be interested in the special service being rendered by the Bennett Propeller Co., Morgantown, N. C. This company supplies propellers to suit the shape of the nose of the plane at regular propeller prices, insuring successful operation.

"From the Ground Up," is the title of a 48 page booklet issued by the Standard Oil Company (Indiana), Chicago, Ill. This book, for free distribution, is one of the finest textbooks we have seen on the elementary principles of aviation. It is beautifully illustrated and well written.

Nine Curtiss "Condors" have been ordered by Eastern Air Transport, Inc., and five of them have been delivered. These ships carry 15 passengers and crew, airmail, airexpress and baggage. Upon the completion of the order, the company will be operating 14 Condors as well as a number of Stinsons and Kingbirds, a total of over 50 airplanes.

Bulletin 200, Airport Color Lighting, has been issued by the Reynolds Electric Company, Chicago, Ill. It describes the Reco color accessories for airport boundary lights, obstruction lights, hangar exterior lights, airway beacons, etc. The bulletin is of interest to airport owners and managers.

The General Sheet Metal and Welding Company, Roosevelt Field, Mineola, N. Y., have received several orders for special streamlining equipment for transatlantic ships.

Full pressure is being applied to the production of the new Glenn Martin, M-130 all-metal flying boats, specially designed for the Pan American-Grace airways. These four motor jobs may go into regular transatlantic service upon completion.

Berry Brothers, Detroit, Mich., report that the total shipment of dope, lacquer and other aircraft finishing materials is about 25 percent. in advance of the shipments made at the corresponding time last year. This is due to the larger types of transport and government planes rather than to the construction of planes for private use.

Transcontinental and Western announce a reduction of 90 minutes in its westbound coast-to-coast mail schedules, and a reduction of one hour in the eastbound transcontinental schedules. This is due to the use of faster planes on the night service west of Kansas City.

The new Sikorsky S-42 four-motored flying boat, the largest in the world, is under way. The engineering work has been completed, but as it is estimated that 18 months will be required for the actual construction, it will be some time before this tremendous boat will show her speed.

Air Associates, Inc., Roosevelt Field, Mineola, N. Y., report that their system of shielding for aircraft radio installations has proved to be one the most effective and least expensive of any on the market.

Waco Sales of New York report that they have sold 16 new Wacos since January 1, 1933. This is a mighty good showing and speaks well for the popularity of the Waco products.

United Air Lines have just issued an extremely interesting and informative booklet bearing the title, "Across the Skyways." It is beautifully illustrated, well written and contains just that information desired by prospective passengers in regard to the equipment, operation and management of the United Air Lines. It may be had for the asking, by addressing United Air Lines, LaSalle-Wacker Bldg., Chicago, Ill.

Ewing Y. Mitchell has just assumed office as Assistant Secretary of Commerce and has supervision over all all of the transportation agencies of the Department of Commerce. Mr. Mitchell was formerly Assistant Secretary of Commerce for Aeronautics, and he has announced that he will give special attention to the problems of the aeronautic industry.

Col. Charles Lindbergh recently tested the new 9-cylinder 700 h.p. Wright Cyclone engine which he has installed on his Lockheed monoplane in preparation for a trip into Greenland for the Pan American Airways. The new engine increased the performance of the Lockheed considerably over that of the 575 h.p. Cyclone originally installed.

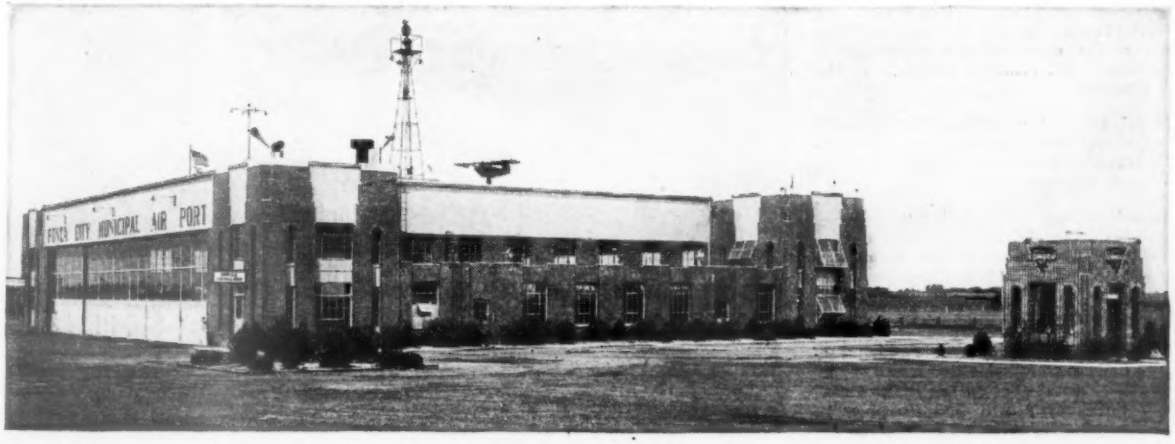
The Boeing Airplane Company is celebrating the seventeenth anniversary of its founding. It started out in 1916 as a one room shop but today it occupies thirteen buildings. Since it began operations in 1916 it has produced approximately 1,800 planes of 53 different types.

Pan American Airways have just purchased 40 per cent stock ownership in the China National Aviation Corporation, the balance of the stock being owned by the Chinese government. American aircraft and American pilots will be employed on the 1,913 miles of airways which serve a population of 150,000,000 people.

The Chance Vought Coroporation, Hartford, Conn., have just completed flight tests on a new single-seater Corsair. This plane, known as Model V-80, has been developed to meet the needs of small nations with relatively small air forces and few airdromes.

Parks Air College, East St. Louis, Ill., are issuing a very newsy bright paper called the "Parks Air News." It is issued monthly and is of great interest to the aviation student and prospective pilot.

An extremely interesting catalogue of aviation equipment has just been issued by Karl Ort, York, Pa. Aside from its commercial aspects, it is a very interesting book and will prove of use to the pilot and builder.



View of the ultra-modern buildings located at Everett Taylor Field, Ponca City, Municipal Airport, Oklahoma. This field has the reputation of being the most modern and best equipped airport in the southwest and has been designed to meet the requirements of the Postal department. See page 200 for complete description.

B. H. Pietenpol, Spring Valley, Minn., has just announced the 1933 edition of the "Air Camper," a Ford powered lightplane.

Production of the fleet of the all-metal single-seater Type P-26A pursuit planes is now under way at the Boeing Airplane Company, Seattle, Wash. Parts have been made up for the first 25 planes.

Practically all of the major airlines report that air traffic has increased tremendously during the past year, in some cases as much as 54 per cent. This does not mean that the depression is over but that air travel is increasing in popularity despite the depression.

Prospects are bright for the National Air Races that are to take place in Chicago, September 1-2-3-4, according to the officials. The Chicago Races in July were very well attended and it is believed that the National event, with its better known pilots, will prove even more successful.

Controllable and variable pitch propellers have become very popular this year, and the makers are busy with the production of new jobs for transports. Hamilton Standard controllable pitch propellers are to be installed on the last 45 Boeing low-wing transport monoplanes to which they give superior performance.

Les Long of the Long Radio Works, Cornelius, Ore., reports that his 2-cylinder Harlequin lightplane engine is meeting with continued success among amateurs.

Many of the larger model airplane companies are going in for all sorts of models, model motor boats, ship replicas, model trains and all the rest of the models of a mechanical or electrical nature.

The aviation world is waiting anxiously to see the outcome of the test flights on the new Gee-Bee transport planes. This is a novel design which may have a profound effect upon passenger carriers, mailplanes and express planes of the future.

O. G. Corben, Madison, Wis., was a visitor last week and stated that there was a steady demand for Junior Ace kits. These little two-seaters are popular among the home-builders and deservedly so.

Passenger carrying sight-seeing trips, in and about Chicago, are more popular than for some time past, in spite of the regulations that prohibit flying over the Century of Progress exhibition. Prices range from 75 cents to $1.50 among the sand-lot ports while a fee of $3.00 per passenger is charged for the concession flights at the fair grounds.

Model companies exhibiting at the Air Show, Century of Progress, report excellent sales volume, particularly with the kits retailing below $1.00.

Jack Rose, 4437 N. Clark St., Chicago, Ill., reports more orders for his single-place light biplane. This little ship, which has already been described in POPULAR AVIATION, is getting to be a popular favorite, in and about Chicago.

The Westinghouse Electric & Manufacturing Company are exhibiting a new superpermeable metal known as "Hypernik" which undoubtedly will find its place in compass and other aviation instrument design. It is highly susceptible to the effects of the earth's magnetism.

Southern Aviation Notes

Bill Arnheim Dates From 1917

He doesn't look so old, but history says that Bill Arnheim's activities date from 1917.

BILL ARNHEIM, Richmond, Va., first became associated with aviation in 1917, when a mere youngster of 16 he was somehow or other permitted to enter the aviation section of the Signal Corps as a rigger.

Subsequently, there followed promotions, training periods in flying and a resignation from the Army to barnstorm with a Jenny of war-time vintage through Florida, Georgia and other Southern States. "Those were the days," says Bill, "when we hopped passengers with the wings supported with bailing wires."

The old bus finally washed out and Arnheim headed for Richmond. Here he plied his trade until he went into the aviation section of the Marine Corps. He remained in the Marines until 1928 and then joined the Curtiss Flying Service at Buffalo as test pilot.

September, 1929, found Bill amid different surroundings. He won appointment as the first teacher of aviation mechanics in the public school system of New York State and served in that capacity with unusual success. The courses having proved so successful in this school, they were installed in two other schools under Arnheim's supervision. The period of instruction, covering four years, was laid out in its entirety by Mr. Arnheim.

In 1931, Arnheim felt strongly the urge for Virginia. He left New York in that year and joined Mary Alexender at Lynchburg in the operation of the Virginia School of Aeronautics. When the school closed in the summer of '31, Bill returned to Richmond where he is living at present.

Frank Coffyn—Early Bird

You're looking at a real oldtimer when you gaze upon the features of Frank T. Coffyn.

FRANK T. COFFYN, born in Charleston, S. C., in 1878, probably stands as the ranking old-timer among Southern airplane pilots. His first connection with aviation dates back to 1910, when he went to Dayton, Ohio, to learn to fly at the Wright Brothers school.

Today, Coffyn and Walter Brookins are the only two survivors of that famous old Wright exhibition team of Brookins, Hoxey, Welsh, Johnstone and Coffyn.

Flying in 1910 was hard work. Flights were made early in the morning when weather permitted, but there was much more to it than the actual flying. The students were their own mechanics and they were always tinkering and making repairs. Beside that it was their job to improve the training field itself.

Capt. Coffyn is still a licensed pilot. He carries with him a small leather case. In one side is his present license, No. 21,425 issued by the United States Department of Commerce, in the other his first license, No. 26, issued by the Aero Club in 1910.

One of the interesting things in connection with the veteran flyer is that Maj.-Gen. Benjamin D. Foulois, the present chief of the air corps, was taught to fly by him.

Suggests Postal Improvement

A LOWER postage rate and a 2-cent postal card to be carried by the airplanes with government contracts would bring about a greater use of the service, said T. Park Hay, promotion manager of

(*Concluded on page* 200)

B. H. Pietenpol, Spring Valley, Minn., proudly puts forth his 1933 production—a Ford motored monoplane. This plane is the culmination of many years experience with flivver planes.

How to Build the Corben Junior Ace

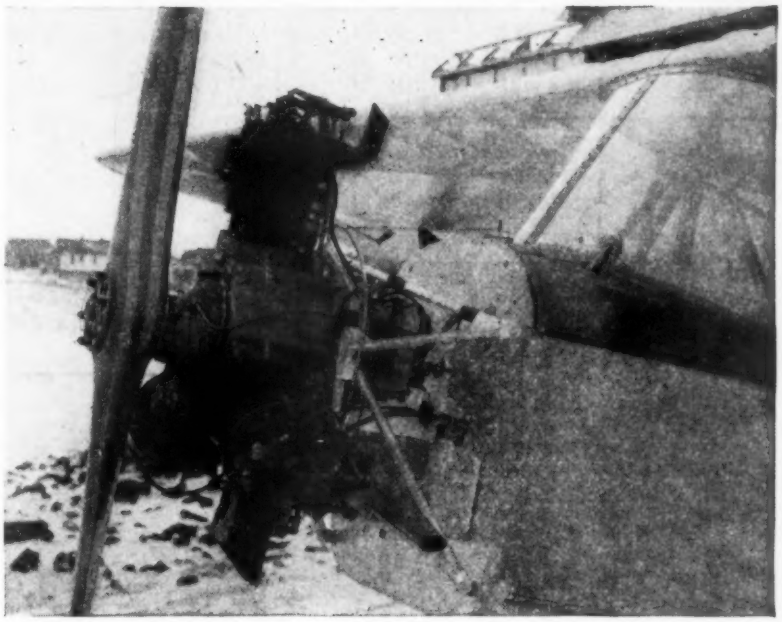
by O. G. CORBEN

THIS is the last article of a series of articles by Mr. Corben, describing the construction of his two-place cabin type monoplane. While the instructions have been written in the greatest detail and completely illustrated by shop drawings, there will probably be some of our readers who desire still further information, and in such a case we will refer them to Mr. O G. Corben, Corben Sportplane Company, Madison Airport, Madison, Wis.

BY the time this issue of POPULAR AVIATION reaches you, no doubt you will have the landing gear and controls finished for your Junior Ace, so this month we will present the dope for building the tail group and wing struts. When these are completed, you will be able to assemble your ship, to make up the control cables, etc.

Before building up the motor mount, the question of "What motor will I use?" comes up and this question is a very important one. In the first article, we told you that the Junior Ace was a reliable sport plane of dependable performance, however, it is quite necessary that a good powerplant be used. Ever since this article began, I have received a great number of letters asking if they could use this or that engine and as their choice seems to vary from a washing machine engine to an old OX-5, I want to take a minute to tell you just what motors you can use on your Junior Ace and still be assured of good performance.

The very first Junior Ace was powered with a Continental A-40 engine, developing approximately 35 h.p. This little four-cylinder motor flew the ship very nicely with one person and carried two with fair performance. Next the Szekely SR3 45 h.p. engine was used and this motor proved to be a very good powerplant, for the ship performed better than most ships with the same motor. The accompanying photographs show the Szekeley installation on the Junior Ace.



Showing how the Szekely 3-cylinder engine is mounted on the Junior Ace. As the design of the mounting varies with the different types of engines, it will be necessary to get further information from Mr. Corben.

We have a soft spot in our hearts for the little Salmson A-D-9 engine and we cannot recommend it too highly. This little motor, as you no doubt know, is a tiny nine cylinder job with a 2¾" bore developing from 40 to 50 h.p. yet the motor weighs only 165 lbs. It is the most dependable little engine I have ever had the pleasure of flying behind and to date I have never had one of these motors set me down.

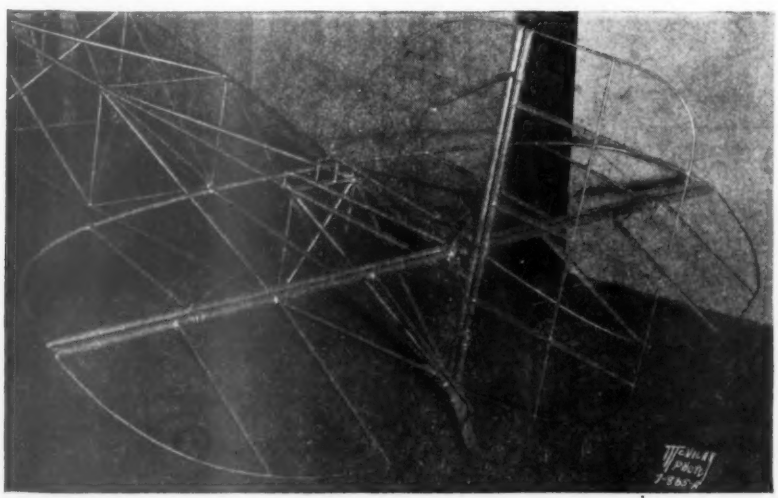
The engine shown in nearly all of the photographs published with previous articles is the Salmson, equipped with a speed ring and I feel sure that you will agree it adds to the appearance of the ship. I wish to add that it is foolish to try converting some kind of automobile or motorcycle engine as you can pick up a good lightplane engine at a very reasonable figure, in fact as low as $100.00 which you will find is by far cheaper than you could convert or build an engine yourself.

You can secure plans for any mount or any engine from the Corben Sport Plane Company, Madison, Wisconsin.

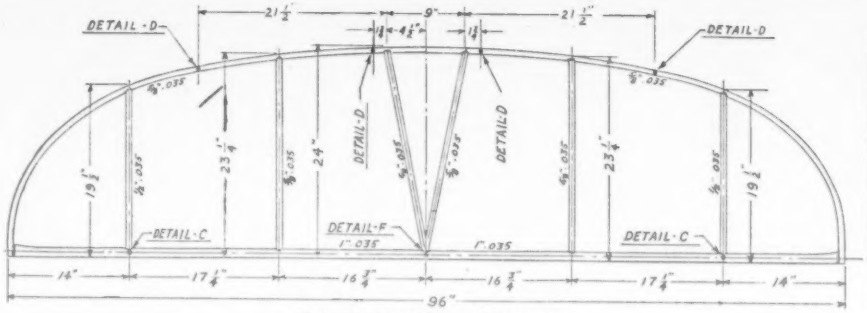
While we are on the engine subject, it might be well to say a word or two about the propeller. You can have the best ship and motor in the world but without a properly designed propeller you may not be able to get your ship off the ground. A propeller that will work on one ship sometimes will not work on another, so keep this in mind when you are ready to get your new propeller.

It has been our good fortune to have

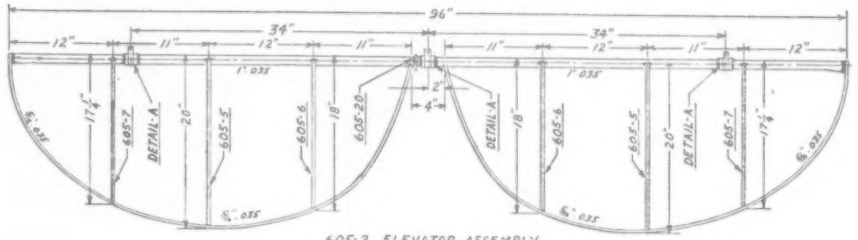
(*Concluded on page* 184)



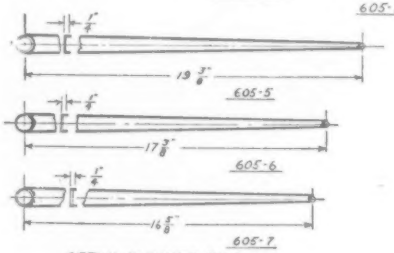
The completed tail-group for the Corben Junior Ace, mounted on fuselage and ready for covering. Drawings for the tail group will be found in this issue



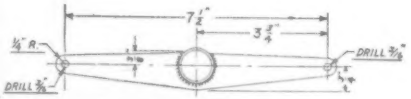
605-1 STABILIZER ASSEMBLY



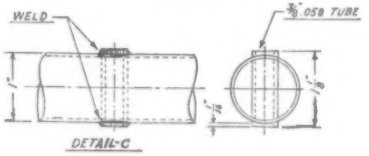
605-2 ELEVATOR ASSEMBLY



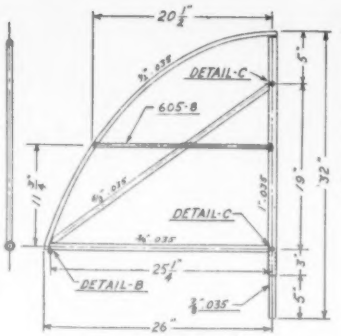
DETAIL ELEVATOR RIBS
MATERIAL 20-GA. 1025 STEEL

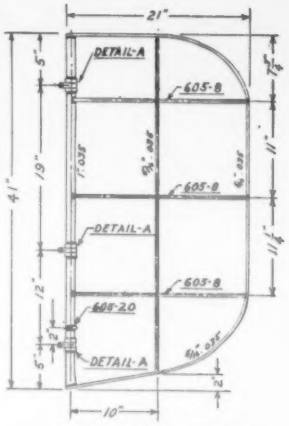


605-20 ELEVATOR & RUDDER HORN
MATERIAL .125 - 1025 STEEL 2-REQD.

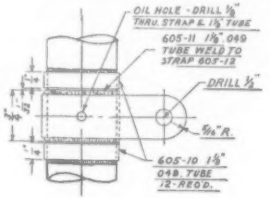


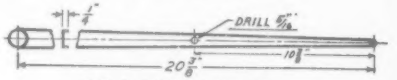
DETAIL-C



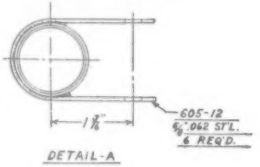


605-3 RUDDER ASSEMBLY



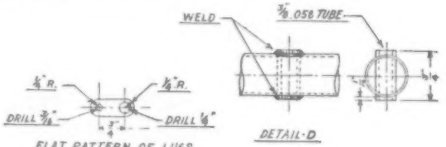


605-8 RUDDER & FIN RIB
MATERIAL 20-GA. 1025 STEEL-9 REQD.
RIB ON FIN IS CUT OUT & WELDED TO
3/8 BRACE AS SHOW ON FIN DETAIL.

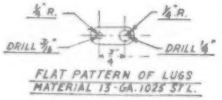


DETAIL-A

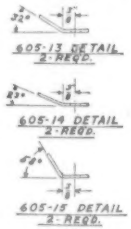
NOTE: ALL TUBING AND STEEL SHOWN ON THIS DRWG. TO BE S.A.E. 1025 STEEL

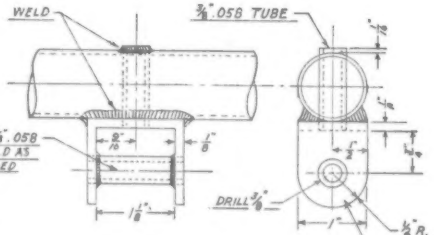


DETAIL-D

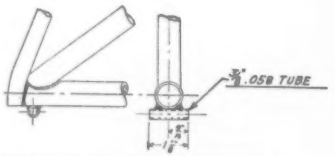


FLAT PATTERN OF LUGS
MATERIAL 13-GA. 1025 STL.





DETAIL-F REAR STABILIZER ATTACHMENT



DETAIL-B FRONT FIN ATTACHMENT

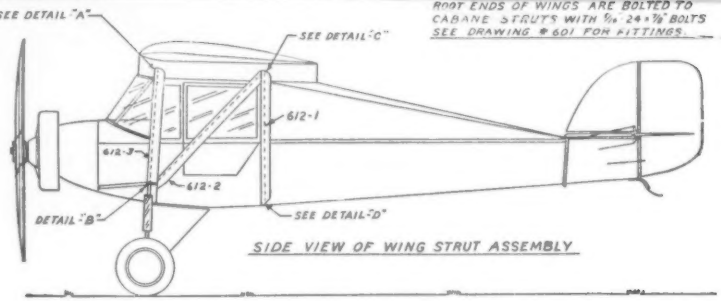
TAIL SURFACES		
CORBEN JUNIOR ACE		
MODEL-6	DATE 2-15-33	SCALE NOTED
CORBEN SPORT PLANE CO.		
MADISON WIS.	605	

NOTE -
ROOT ENDS OF WINGS ARE BOLTED TO
CABANE STRUTS WITH 5/16 24 x 7/8" BOLTS
SEE DRAWING # 601 FOR FITTINGS

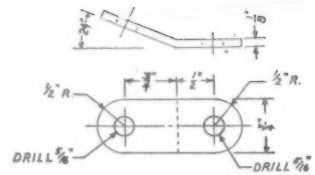
DETAIL-C

CORBEN JUNIOR ACE		
MODEL-6	DATE 2-15-33	SCALE NOTED
CORBEN SPORT PLANE CO.		
MADISON WIS.	605	

NOTE - ROOT ENDS OF WINGS ARE BOLTED TO CABANE STRUTS WITH 7/16"-24 x 7/8" BOLTS SEE DRAWING # 601 FOR FITTINGS.

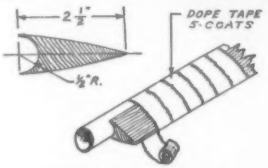


SIDE VIEW OF WING STRUT ASSEMBLY



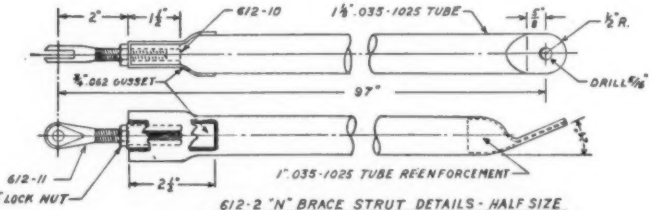
612-9 DETAIL "N" STRUT FITTING

MATERIAL - 5/8" .125-1025 STEEL-2-REQD.



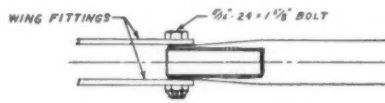
STREAMLINE DETAILS

MATERIAL-WHITE PINE-TAPE TO REAR OF ALL WING STRUTS AS SHOWN

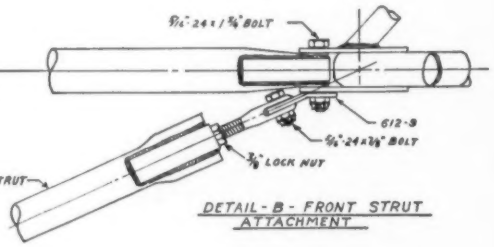


612-2 "N" BRACE STRUT DETAILS - HALF SIZE

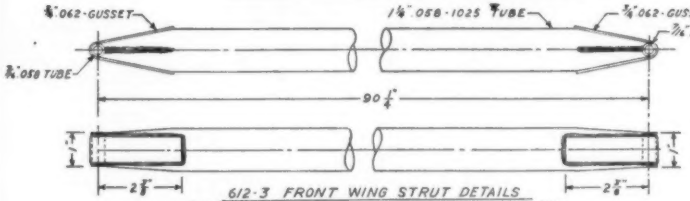
2-REQD PART OF GUSSET OMITTED IN PART- HEAT ENDS & SHAPE AS SHOWN- CUT 1/4 SLOTS AND WELD 612-10 -



DETAIL "A" FRONT STRUT ATTACHMENT

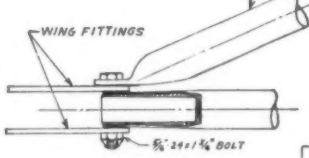


DETAIL - B - FRONT STRUT ATTACHMENT



612-3 FRONT WING STRUT DETAILS

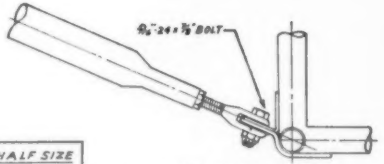
2-REQD - REDUCE ENDS BY CUTTING 4 "V" SLOTS AND WELD AS SHOWN WELD 1/16" TUBES AT ENDS & GUSSET



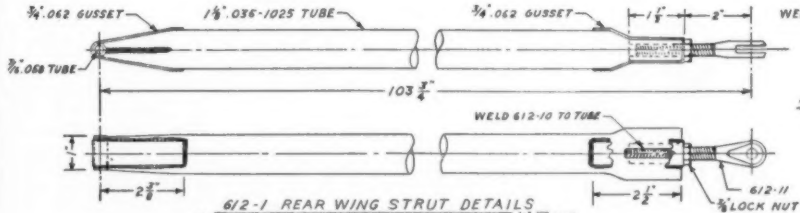
DETAIL "C" REAR STRUT ATTACHMENT

ALL STRUT DETAILS - HALF SIZE

ALL BOLTS ARE "A-N" SPECIFICATION NICKEL STEEL - USE CASTEL "A-N" NUTS COTTER WITH 1/16" x 3/4" COTTER PINS



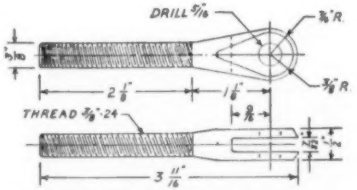
DETAIL "D" REAR STRUT ATTACHMENT



6/12-1 REAR WING STRUT DETAILS

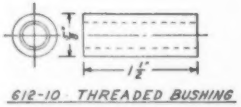
2-REQD. MAKE UP ENDS AS SHOWN - CUT 1/4 SLOTS & WELD IN 612-10 SEE END VIEW - ALL GUSSETS 1025 STL.

END VIEW 612-11 OMITTED



612-11 STRUT END AJUSTMENT

MATERIAL "A-N" SPECIFICATION NICKEL STEEL - 4 - REQUIRED



612-10 THREADED BUSHING

MATERIAL 5/8" SAE 1025 STEEL TAP OUT 3/8"-24 4-REQUIRED

WING STRUT ASSEMBLY		
CORBEN JUNIOR ACE		
MODEL-6	DATE 4-29-33	
CORBEN SPORT PLANE CO.		
MADISON WIS.	612	

Junior Ace

(*Continued from page* 181)

Mr. Lorenzen of the Lorenzen Propeller Company, Niles, Michigan, work with us in the designing of a suitable propeller for the Junior Ace and after several designs and types were tried out we finally hit upon a 76" diameter propeller with a 3 ft. 6 in. pitch for use with the Salmson engine. This propeller gives the ship a very good take-off and climb with a good cruising speed which is an ideal combination for an all-round sportplane.

Now that we have the motor and propeller question hashed out we will start to build up the tail group which is shown in detail on print No. 605. You can see at a glance that the construction is of steel tubing with the exception of the rudder and elevator ribs which are of formed sheet steel. This type of construction is the lightest and best available as well as being the easiest to build up.

The hinges are made up of tubing and strap steel as shown in detail A. It is necessary that all hinges, both on the rudder and elevators, be slipped on the spars and in their proper places before you make up the units. The collars should also be in place.

After you have all of the welding done on the fin and stabilizer, fasten the hinges in their places and tack weld the collars in place on the spars as shown on the rudder and stabilizer assembly. Detail F shows the fitting for the rear stabilizer attachment to the fuselage.

The control horns are welded to the spars as detailed. The lugs shown are for the tail group brace wires, these should be made up and put aside until later. I believe that the plans are self-explanatory.

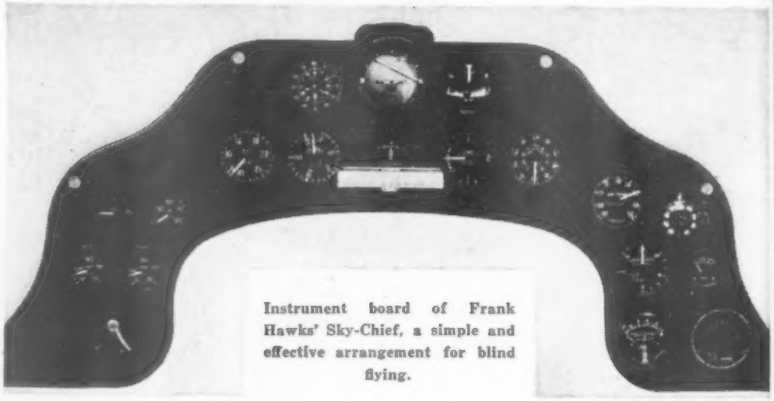
Print No. 612 shows all the details for making up the wing struts together with the necessary fittings. The strut end adjustment can be made up in any machine shop or they may be purchased at an aerial supply house probably cheaper than you could have them made up. In making the wing struts, remember they play a very important part in the safety of your ship and every care should be taken to make the best welds possible and use only the materials specified in the drawing. All bolts shown are to be nickel steel. Ordinary steel machine bolts will not be strong enough so don't try to use them.

After you have all the struts built up, the assembling of the different units such as wings, tail group etc., rig the ship completely before you do any covering, making sure that everything fits and that nothing binds.

Make up all of the control cables, being sure that you connect them up

(*Concluded on page* 198)

Special Equipment in Hawks' Sky-Chief



Instrument board of Frank Hawks' Sky-Chief, a simple and effective arrangement for blind flying.

WHEN Lieut. Commander Frank M. Hawks landed in New York, breaking his own non-stop trans-continental record of four years standing, he brought with him a handful of tricks new in the aviation industry.

The flight was essentially noteworthy because it constituted the first robot-controlled non-stop transcontinental air journey, but aside from that and when the excitement attendant upon the new record died down, aviation observers saw a new wrinkle in maintenance of the many delicate instruments with which Hawks' Texaco Sky-Chief is equipped.

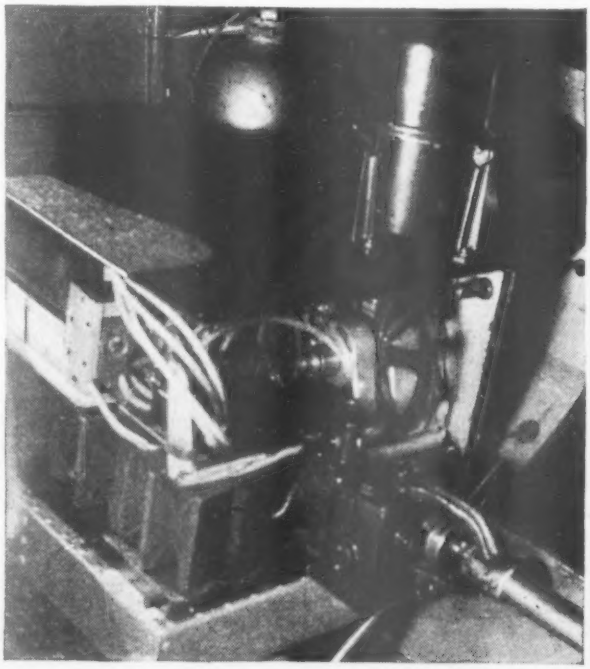
The ship first presented an electrically heated pitot tube, preventing "icing" up" the tube on the leading edge of the wing and the consequent danger to the functioning of the air speed indicator.

Another new feature was a venturi tube mounted between the 14 cylinder Wright Whirlwind engine. Through this arrangement, the venturi, which produces suction to operate the turn and bank indicator, directional gyro and the artificial horizon, is kept warm and safe from ice danger. Being in the center of the nose it contributes no parasitic resistance or drag such as would be the case if the venturi was attached to the outside structure.

Commander Hawks, however, was particularly enthusiastic about his automatic robot control. In his latest 13 hour, 27 minute flight from Los Angeles to New York he said he felt far less fatigued than on his previous non-stop record jump in June of 1929 when he came from California in 17 hours, 36 minutes. This, of course, was due in part to the shorter time spent in the air, but more especially to the robot which guided the Sky-Chief for 1,500 miles of its 2,440 mile Great Circle course across the nation.

Hawks' robot comprises two parts—one a box-like container holding the pendulums on which the robot functions and the other is the control unit. The robot weighs only 25 pounds.

(*Concluded on page* 209)



The robot or automatic pilot installed on Frank Hawks' Sky-Chief with which he made a transcontinental flight record.

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

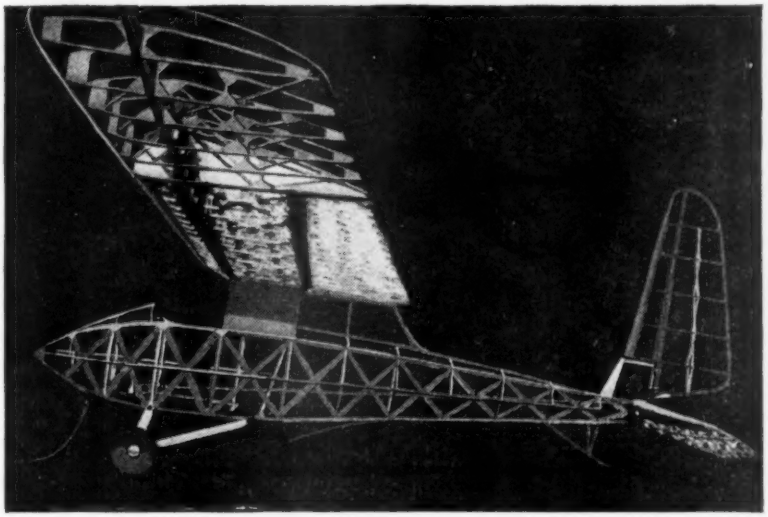
Carbureter Protection

FOR successful flights in all sorts of weather, the carbureter must be kept warm—more particularly the air intake. If the carbureter is left exposed, as it is on most amateur ships, there is likely to be trouble in cool or cold weather due to the intake becoming clogged up with frost.

"Aw, I know all that," will exclaim all of the bunch, but as a matter of fact, 99.44 per cent of them overlook the carbureter when they start building their ship. Comes a flight in the cool Fall, and then they wonder why their engine speed goes down gradually until some times the engine cuts out altogether. On examination, the intake will be found filled with frost.

Now, the carbureter is quite an effective refrigerating machine that will remain colder than the surrounding air by many degrees unless it is supplied with heat from the engine. The evaporation of the gasoline in this small space removes the heat rapidly, and if allowed to persist, frosting will result. It is all right to have the carbureter accessible for adjustment but at the same time, it should be well covered and protected while in flight. The inlet should be placed so that there will be no danger from back-fires.

A California Glider Built by Artist



This photo of Mr. Woolhiser's glider has been slightly retouched in order to make the various parts stand out in relief but the photo has in no way been altered.

ABOUT two years ago, H. Woolhiser and three of his friends started to build the sailplane shown here which is an original design though following somewhat along the lines of the Bowlus sailplane. The oldtimers will probably remember the covers drawn by Mr. Woolhiser for POPULAR AVIATION.

The span is 60 feet, and while the wings are of the cantilever type, two struts have been added so as to reduce the stresses on the wing.

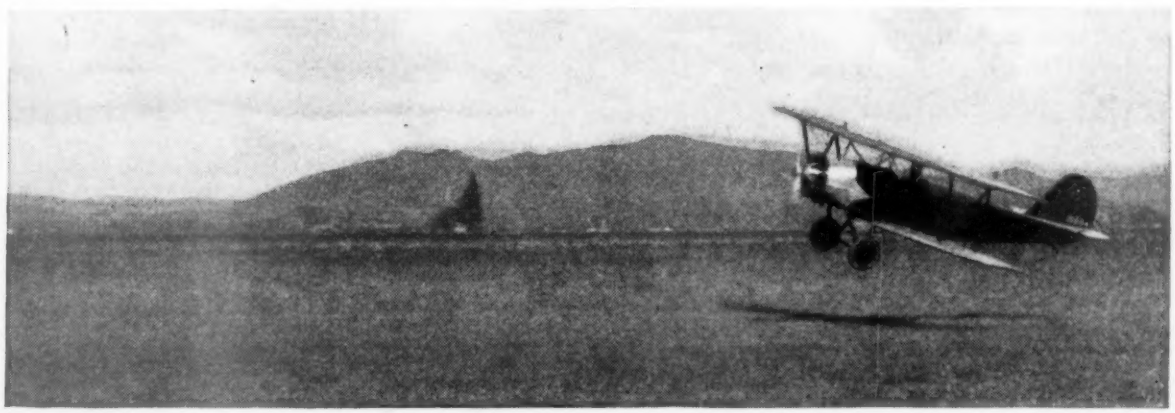
This Reader Sends Us a Flight Picture of His Homebuilt Ship

AND now let us present Mr. Elmer L. Smith and his little biplane. This Mr. Smith is from Eugene, Ore., and while this plane has been pictured before in these columns, it is now resplendent with an A.D.9. Salmson in place of the old Henderson engine which never developed sufficient power to fly the ship.

It now has a top speed of 90 m.p.h., measured by a stop watch and lands at 38 m.p.h. With a Les Long Special propeller fitted to the new engine, the ship cruises at 70 m.p.h. with the prop turning at 1650 r.p.m.

It is said that Jim McManimin did all the engineering work on the plane during the power plant alterations and that credit for its flying ability must go to him.

Span, upper wing	22'-6"
Span, lower wing	20'-6"
Airfoil section	Clark "Y".
Total wing area	125 sq. ft.
Length	16'-6"
Weight empty	459 Lbs.
Powerplant, Salmson	40 h.p.

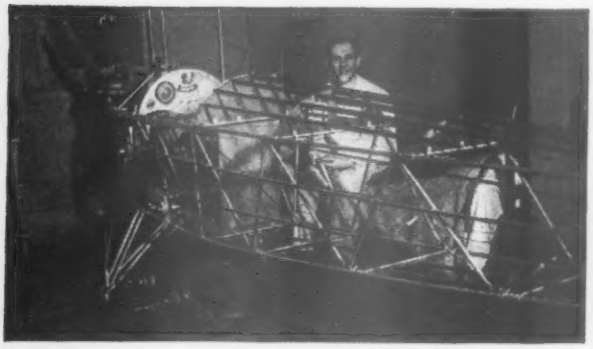


And away she goes, taking off in a way that would please any pilot, amateur or professional. This lightplane, built by Elmer Smith of Eugene, Ore., is a mighty neat looking little job and flies very well.

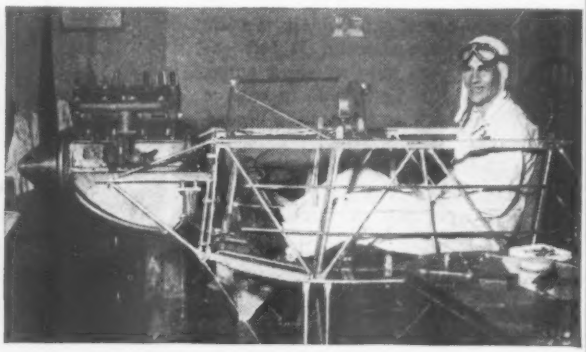
He Builds 'em In Bedrooms

by STANLEY ROWAN

This is the story of a plucky young man, who despite many serious financial reverses, went sturdily to work and built himself a lightplane under unbelieveable difficulties.



Here's Stanley Rowan sitting on his bed while assembling and adjusting his Heath Fuselage. Looks comfortable and homelike, though, even though not suited for volume production. Wings are on the wall.



Mr. Rowan, the future pilot, gives her a metaphysical test-hop within the confines of his boudoir. Engine's installed and she's rounding out into a real ship. Contact!

WHEN the aviation bug bites, it bites way down deep where you can't scratch the spot. And so it was with Stanley Rowan, Chicago, who has encountered all sorts of obstacles in the path of aviation but who still goes gamely battling on.

Stanley's story is the same as the story of hundreds of other young men who have become fascinated with the flying game—the same but with one exception. We believe and will continue to believe, that Stanley Rowan is the sole and only bedroom airplane constructor. We will let you tell his story himself, a mixture of humor and pathos.

* * *

HERE is the story of my aeronautical activities—illustrated. I came to Chicago in 1929 from Evans City Pa. My purpose in coming was to attend a flying school in Chicago which went into bankruptcy before I had completed my course and was closed.

I then had to look about for another chance to take flying lessons, but to pay for dual instruction and the use of a plane for 200 hours was simply out of the question. I had to figure out something better than attending a school, at least better from a financial standpoint, in order to get my transport pilot's license.

And so I investigated the lightplane route, building a lightplane myself from a kit and thus reducing the cost of the 200 hours required by the Department of Commerce. But I soon found that even the cost of the kit, about $200, would be quite a jolt to my pocket-book. Fortunately, about that time, POPULAR AVIATION started printing directions on the building of the Heath Parasol.

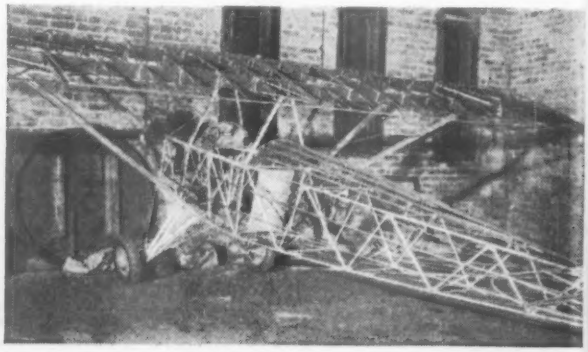
It was good looking, so I sent to Heath's for their literature. I was greatly impressed with their story, mostly for the reason that they had arranged the material into eleven groups which could be purchased separately on the installment plan, and by this means it was possible to start construction with a capital of only $12. I then went out to their factory, which at that time was here in Chicago, and asked to see one. I took a couple of looks and said, "I'll take group No., 1," and paid my 12 bucks.

And so I started the big job—no quitting now! I started with the wing ribs and as I had just about enough spare time each day to make one rib, it took 26 days for the 26 ribs. Since I was working about 50 hours per week, at a wage of 40 cents an hour—not a very fancy wage if you ask me—I could not see my way clear to rent a shop. And so, after a lot of close calculating, I decided to do the work in my bedroom.

I had to be quiet, so as not to disturb the other roomers, and this took additional care and time. Again, my room was the center of attraction for the whole house, everyone coming in to see it sooner or later, so that these conversations and interruptions added some more lost time to the total lost time. Others came into the room to borrow tools which were never returned, adding still further the loss of time and expense. Let me tell you, building a plane in a boarding house bedroom is no bed of roses if you get what I mean.

(*Concluded on page* 209)

Here is a view of the fuselage, instrument-board, bed and the calendar by which Stanley establishes his various deadlines.



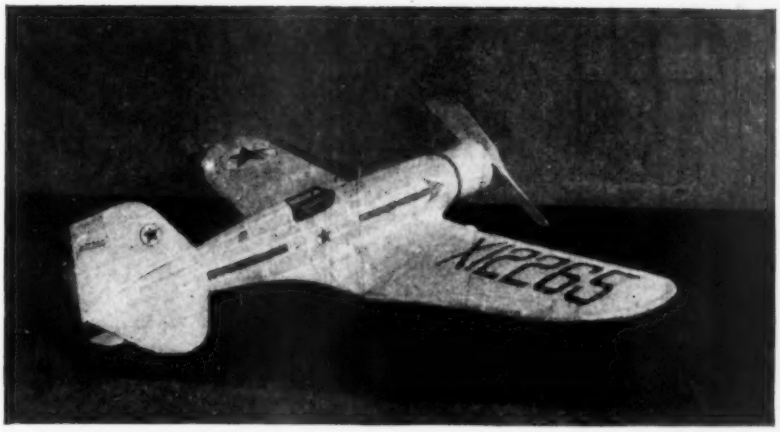
Here she is, wings mounted, landing gear completed and already to cover. No, this is not Stanley's bedroom, it's in the alley behind the bedroom.

Building the Northrop "Gamma"

by

JACK KNOBLE

This is the first professional article by a well known Chicago model designer.



The model of the Northrop "Gamma, complete down to the Texaco star and the license numbers. An exceptionally good flying model.

IF you're looking for a sweet flyer or a trim looking scale model, be sure to build the Northrop "Gamma" layed out on the following pages.

The ship described, has been designed with close regard to aerodynamic design, which you know is very important to a good flying model. Also, it has been built and rebuilt by the author several times and test flown to observe its points of weakness.

You will find the plans very accurate and you will have little difficulty in construction.

The wing span of the model is 25 inches, the fuselage length 15 inches and the height 4 3/16 inches. The weight is about 2½ ounces.

CENTER-SECTION

Begin by cutting 4 ribs as shown on the side view at "A" from 1/16 inch sheet balsa. Set them in a perpendicular position with pins on your construction board in their respective positions as indicated on the top view. Then cement 1/16 inch stringers across them in the notches. After they have dried, cement the leading and trailing edges and shape them when they are dried thoroughly.

FUSELAGE

Cut the fuselage formers out of 1/16 inch sheet balsa. If they are too large to fit on a sheet, make them in halves and cement them together. After all the formers are cut out, cement them on the fuselage stick (12 3/16"x 3/16"x⅛"), spacing them according to the measurements on the side view. Be very accurate in lining them up.

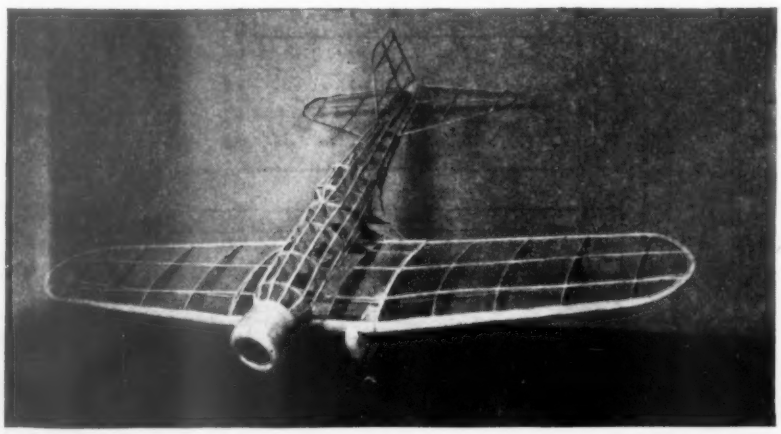
After they have thoroughly dried in position on the fuselage stick, spread cement on the bottom of formers Nos. 3, 4, 5 and 6 and place the former assembly on the centersection so that formers 3, 4, 5, and 6 will rest on the three 1/16 inch stringers and the trailing edge of the center section. Be sure it is centered properly, then hold the formers in place until the cement has set.

Now, lay the fuselage stringers in their notches and cement them. Work by putting a stringer in one side and then the oppsite side. Don't start on one side and go right around as this will throw the fuselage out of line.

Cement the rough tail block in place and carve it to shape after it has dried in place. Bend the rear motor hook out of .033 inch music wire and push it through the tail block from the inside of the fuselage. Then bend it around from the outside and cement.

Make the cockpit housing out of small pieces of 1/16 inch square balsa and paint them a dull black. After the paint has dried, cement pieces of celluloid over the framework of the housing for windows. Also cement the paper dashboard in place on former No. 5.

Bend reed to fit on the tips of formers 6, 7 and 8 and cement in place. Take scraps of 1/16 inch balsa and fill in the space between former No. 2 and the leading edge of the center section so it will paper smooth. Cut two pieces of ⅛ inch square balsa and place parallel to the fuselage on the bottom part of the center section where the wheel spats connect to the fuselage for reinforcement. (Dotted lines in top view on outer edge of C. S. wing.)



The frame of the "Gamma ready for covering. Its construction is simple but strong enough to withstand hard usage.

TAIL SURFACES

Lay the elevators and rudder out flat on your construction board. Make the curved parts out of 1/16 inch dia. reed by beinding it over a candle or alcohol flame. All other construction is 1/16 inch square balsa.

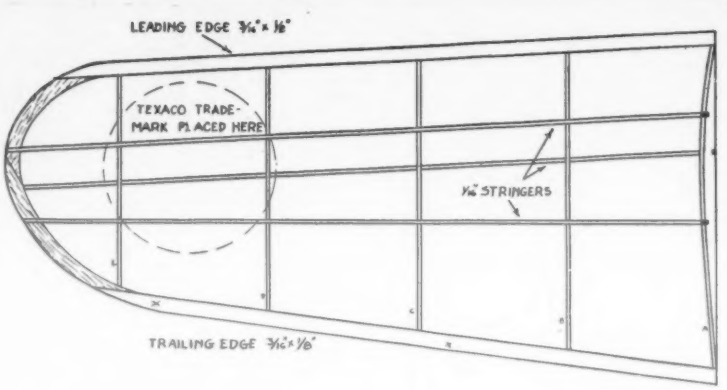
WHEEL SPATS

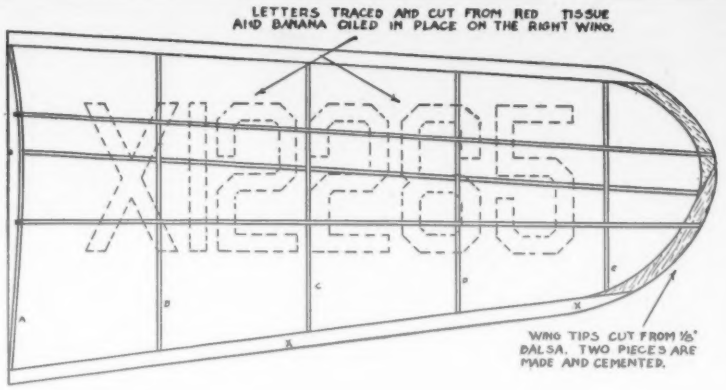
Each spat has two pieces of ⅛ inch sheet balsa for its sides and a ¼ inch sheet for its center-piece. The ¼ inch sheet is cut out to fit the wheel and the ⅛ inch sheets are cemented to each side. The three pieces are cut to shape before they are cemented.

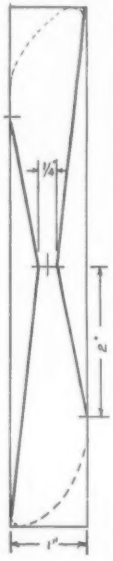
The wheel is of celluloid or can be made from two pieces of 3/32 inch sheet balsa cross grain 1¼ inch in dia.

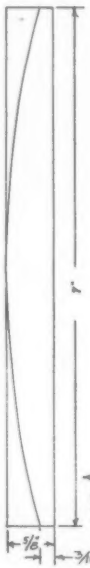
After the spats have dried cut, sandpaper them to shape. Give them two coats of banana oil and two coats of white paint. Sand after each coat of banana oil. Stripe two red lines on each

(*Continued on page* 190)




LETTERS TRACED AND CUT FROM RED TISSUE AND BANANA OILED IN PLACE ON THE RIGHT WING.
WING TIPS CUT FROM 1/8" BALSA. TWO PIECES ARE MADE AND CEMENTED.



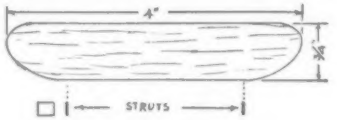


CARVE THE FLYING PROPELLER FROM A BLOCK, AS SHOWN HERE.

MATERIAL LIST		
SIZE	MATERIAL	QUANITY
1/16" Sq. X 24"	BALSA	12 pcs
3/16" x 1/8"	"	31 "
2" x 1/16" x 24"	"	2 pcs
2" x 1/8" x 24"	"	1 pcs
2" x 1/32 x 24"	"	1 pcs
2" x 1/4" x	"	6"
3/16" x 1/2"	"	24"
2" x 2" x 1/32"	"	1 pcs
1/16" x 1" x 3/4"	"	1 pcs
1" x 1/8" x 7"	"	1 pcs
1/16" RD.	REED	12"
.014"	PIANO WIRE	8"
1/16" WASHERS	BRASS	6
1/16" TUBEING	ALUMINUM	1/4"
2"x2"x.005" SHEET	"	1 pcs
1 1/4" WHEELS	CELLULOID	2
1/8" x 1/16" FLAT	RUBBER	72"
	CEMENT	1 TUBE
	BANANA OIL	3 oz.
8" x 12"	TISSUE (RED)	1 sheet
21" x 31"	" (WHITE)	1 sheet
6" x 3"	SHEET CELLULOID	1 pcs

ALSO AN ASSORTED COLORS OF LIGHT PAINT FOR DETAILS ON PLANE.

THE DESIGNER, IN FRONT OF HIS SHOP, HOLDING THE FINISHED NORTHROP "GAMMA".



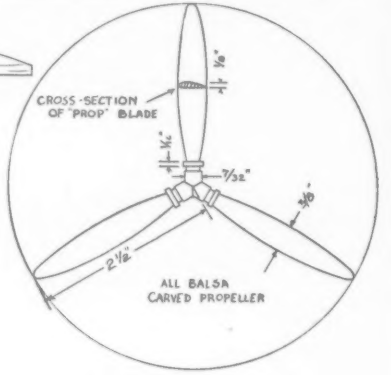
AILERONS SET ON THE TRAILING EDGE ON EACH WING, "X" MARKS INDICATE THEIR POSITIONS. AILERONS ARE CUT FROM 1/32" FLAT BALSA.

NOTE!

Be careful in the use of cement, because cement is heavy and by using excessive amounts, the weight may be in excess of the estimated weight. Only use large drops of cement where the text calls for it.

Careful papering, avoidance of buckled, wrinkled and flabby surfaces will reduce the resistance and correspondingly increase both the speed and duration.

PROPELLER FOR THE SCALE MODEL—NON-FLYING.



NOTE!

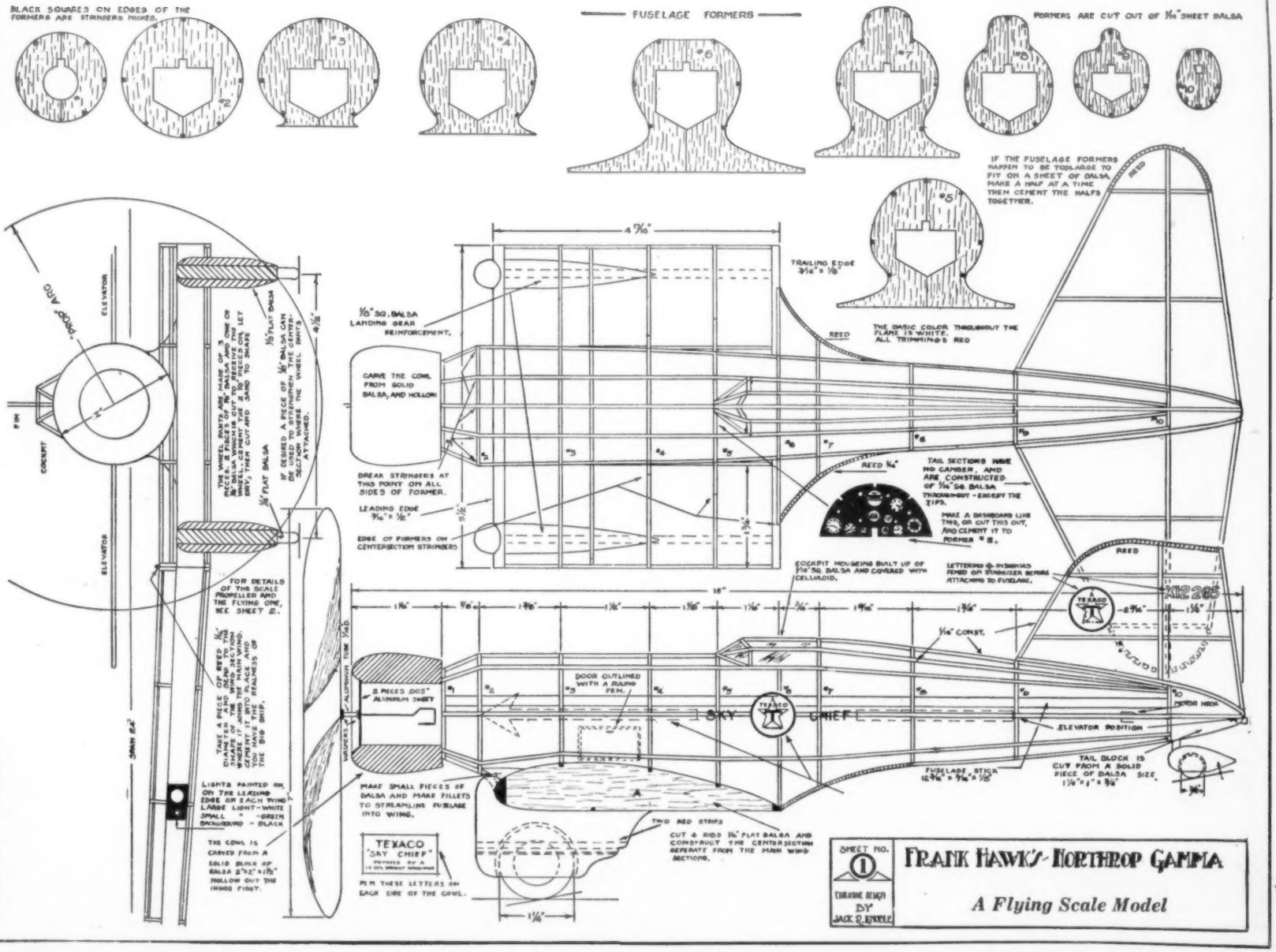
Too much care cannot be taken in the construction of the propellers. Some experimenting may be necessary for determining the proper pitch, but in general, this best pitch will not be far from that specified in this article. And, further, the pitch of all three blades must be exactly the same to avoid heavy power losses.

SHEET NO. 2

DESIGN BY J. KNOBLE

FRANK HAWK'S - NORTHROP "GAMMA"

A Flying Scale Model


BLACK SQUARES ON EDGES OF THE FORMERS ARE STRINGERS NICHED.
FUSELAGE FORMERS
FORMERS ARE CUT OUT OF 1/16" SHEET BALSA
IF THE FUSELAGE FORMERS HAPPEN TO BE TOO LARGE TO FIT ON A SHEET OF BALSA, MAKE A HALF AT A TIME THEN CEMENT THE HALVES TOGETHER.
THE BASIC COLOR THROUGHOUT THE PLANE IS WHITE. ALL TRIMMINGS RED
TRAILING EDGE 3/16" x 1/8"
1/8" SQ. BALSA LANDING GEAR REINFORCEMENT.
CARVE THE COWL FROM SOLID BALSA, AND HOLLOW
REAR STRINGERS AT THIS POINT ON ALL SIDES OF FORMER.
LEADING EDGE 3/16" x 1/8"
EDGE OF FORMERS ON CENTERSECTION STRINGERS
4 7/16"
REED
REED 1/4"
TAIL SECTIONS HAVE NO CAMBER, AND ARE CONSTRUCTED OF 1/16" SQ. BALSA THROUGHOUT - EXCEPT THE TIPS.
MAKE A DASHBOARD LIKE THIS, OR CUT THIS OUT, AND CEMENT IT TO FORMER "8".
COCKPIT HOUSEING BUILT UP OF 1/16" SQ. BALSA AND COVERED WITH CELLULOID.
LETTERING & INSIGNIAS REMD ON STABILIZER BEFORE ATTACHING TO FUSELAGE.
18"
1/16" CONST.
DOOR OUTLINED WITH A RUNG PEN.
3 PIECES .005" ALUMINUM SHEET
SKY CHIEF
ELEVATOR POSITION
FUSELAGE STICK 12 3/16" x 3/16" x 1/8"
TAIL BLOCK IS CUT FROM A SOLID PIECE OF BALSA SIZE. 1 1/4" x 1" x 3/4"
MAKE SMALL PIECES OF BALSA AND MAKE FILLETS TO STREAMLINE FUSELAGE INTO WING.
TWO RED STRIPS
CUT 4 RIBS 1/16" FLAT BALSA AND CONSTRUCT THE CENTERSECTION SEPARATE FROM THE MAIN WING SECTIONS.
TEXACO "SKY CHIEF"
PEN THESE LETTERS ON EACH SIDE OF THE COWL.
1 1/4"
PROP ARC
ELEVATOR
COCKPIT
PIN
2"
THE WHEEL PANTS ARE MADE OF 3 PIECES EACH. CUT TWO PIECES ONE OF 1/16" BALSA WHICH IS CUT TO RECEIVE THE WHEEL, CEMENT THE TWO PIECES ON LEFT AND THEN CUT AND SAND TO SHAPE
1/16" FLAT BALSA
IF DESIRED A PIECE OF 1/16" BALSA CAN BE USED TO STRENGTHEN THE CENTER SECTION WHERE THE WHEEL PANTS ATTACHED.
4 1/2"
FOR DETAILS OF THE SCALE PROPELLER AND THE FLYING ONE, SEE SHEET 2.
TAKE A PIECE OF REED 1/4" DIAMETER AND 3" LONG AND SHAPE IN THE FORM OF THE WIND SECTION SHOWN IN THE PLAN AND SIDE VIEW. THIS WILL AID YOU HAVE THE REALNESS OF THE BIG SHIP.
LIGHTS PAINTED ON ON THE LEADING EDGE OF EACH WING
LARGE LIGHT - WHITE
SMALL " - GREEN
BACKGROUND - BLACK
THE COWL IS CARVED FROM A SOLID BLOCK OF BALSA 2 3/4" x 1 1/8" HOLLOW OUT THE INSIDE FIRST.

FRANK HAWK'S - NORTHROP GAMMA

A Flying Scale Model

SHEET NO. 1

ENGINE DESIGN BY JACK D. KNUDLE

Northrop Gamma

(*Continued from page* 187)

side with a ruling pen as shown and lay aside to dry.

COWL

Carve the cowl from a solid piece of balsa, 2" x 2" x 1½" and hollow it out so the walls will be about ½ inch thick. Sand it down well and apply 2 or 3 coats of banana oil and sand after each coat.

Now give the cowl two coats of white lacquer and pen the lettering on each side in red ink as shown in the plans.

Cut two pieces (circles) of .005 inch aluminum to fit the nose of the cowl, and cement them in place after punching a small hole for the propeller shaft.

The cowl is held in place against the fuselage by cementing pins in the cowl and leaving the points stick out about ¼ inch. Aluminum tubing may be set in former No. 1 to accommodate these pins or they may just be allowed to stick in the wood. The tension of the rubber motor will hold the cowl in place.

THE WINGS

The wing is layed out on your construction board. Begin by cutting out two ribs from 1/16 inch sheet balsa the same size as the four you cut out for the center section. When you have these finished cut two of each of B, C, D and E.

Pin down a strip of balsa 3/16 inch x ½ inch for your leading edge, first laying a flat piece of 3/32 inch stock under it to raise it up so the ribs will join it properly. Now pin all the ribs in position and cement them to the leading edge. (*But not the "A" rib*). Trim off the trailing tip of the ribs and lay the trailing edge in place and cement.

Cut the wing tips out of ⅛ inch flat balsa and cement them in position, being sure to raise the tips up to the same height as the leading edge with 3/32 balsa.

Now lay 1/16 stringers of balsa across the top of the ribs as shown on the wing plan and cut notches to fit them and then lay them in and cement. Remember, all this time the "A" rib is not cemented in yet.

Now, you have the rough wing constructed and will now have to put the dihedral in. Rest the wing tip on some sort of block, 1 inch high and pin the whole wing in place this way. This work must be done on a flat and even surface. Take a square and set one edge on the board you are working on then slide it along the board till the other perpendicular edge touches rib "A" and make this rib stand upright with the square. When this rib is all square cement it. When it is thoroughly dry connect the stringers from the

(*Concluded on page* 197)

Winning Model at American Races Does 66.66 m.p.h.

George A. Bray, president of The Junior Association of Commerce of Chicago, (left) is shown presenting POPULAR AVIATION'S Grand Sweepstake Prize to Robert Pekelsma, winner in the American Model Airplane Speed Tournament. Joseph Lucas, Director of the Field Events, is standing at the extreme right, holding the winning model.

DURING The American Model Airplane Speed Tournament, sponsored by The Junior Association of Commerce of Chicago, on July 1-2-3-4, at the American Air Races—two world model airplane speed records were broken by Robert Pekelsma and Willard Ewing of Chicago.

Mr. Pekelsma's model was of the rubber driven hand launched flying-stick type. It covered the 176 foot course at a speed of 66.2/3 M.P.H. Mr. Ewing's model was of the R.O.G. Fuselage type and covered the same course at a speed of 37.38 M.P.H. The former stick type speed record was made by John Rappold of Chicago at 57 M.P.H. while the former Fuselage Speed record was held by R. N. Bullock of England, 35 M.P.H.

Not only did Robert Pekelsma break the world's flying-stick type record, but he also won the Grand Sweepstake Prize for the most worthy contestant in the model tournament. The Sweepstake Prize was donated by POPULAR AVIATION and Robert was very happy to receive the P. A. trophy as a grand prize. Mr. Pekelsma in order to win the POPULAR AVIATION Grand Prize, had to win first place in each of the elimination trials and the finals of the Stick Model Events, as well as placing fifth in each of the Elimination tests and finals of the fuselage events.

Twenty-five prizes were given during the American Model Airplane Speed Tournament including the gold and silver medals given by The Junior Association of Commerce of Chicago.

The Grand Prize, the first, second and third place winners of the various events are listed below with their awards as well as their times and miles per hour (M.P.H.).

Because of the automatic speed recorder used, this timing is much more exact then the timing at past meets.

Event No. 1 Finals Stick Model

Senior

	Average Flight
Robert Pekelsma, United Air Line Trophy	2 sec.
6408 S. Emerald Ave.	60 M.P.H.

Pekelsma's first flight time was 1 8 seconds at a speed of 66.2/3 M.P.H. (World Record).

Teen Becksted, Gold Medal	2.43 sec.
5336 Addison St.	49.8 M.P.H.
Willard Ewing, Silver Medal	2.46 sec.
6449 Parnell Ave.	47.78 M.P.H.

Junior

Robert Reder, Comet Model Airplane Trophy	2.93 sec.
1928 S. Hamlin Ave.	49.13 M.P.H.
Wallace Simmers, Gold Medal	4.166 sec.
New Lennox, Ill.	28.80 M.P.H.
Robert Kock, Silver Medal	4.3 sec.
4734 W. Austin Ave.	27.90 M.P.H.

Event No. 2 Fuselage Finals

Senior

	Average Flight
Stephen Klazura, Senior Curtiss Wright Trophy	3.906 sec.
8078 Exchange Ave.	30.69 M.P.H.
Bill E. Atwood, Gold Medal	3.98 sec.
1626 Prairie Ave.	30.15 M.P.H.
Edward Almquist, Silver Medal	3.99 sec.
649 W. 80th St.	30.08 M.P.H.

Junior

E. D. Kozlowski, Junior Curtiss Wright Trophy	5.54 sec.
8120 So. Shore Drive	22.64 M.P.H.
Robert Perry, Gold Medal	9.89 sec.
6042 N. Oakley Ave.	12.13 M.P.H.
Wallace Simmers, Silver Medal	10.13 sec.
New Lennox, Ill.	11.84 M.P.H.

Willard Ewing, who finished fourth in the Senior Fuselage Finals made the record breaking flight in 3.21 seconds at a speed of 37.38 M.P.H. over a 176 foot course during his second official flight.

Over 275 contestants from all parts of the country participated in this tournament. One of the main features of the model tournament was the use of an electric timing instrument. The electric timing instrument for the first time used in any model meet, has proved its worth in efficiency as well as for accuracy. The American Model Airplane Speed Tournament was under the direction of Joseph J. Lucas.

Because of the high speeds attained, the winning models were what might be called "flying bricks." They were necessarily very heavy with small wing areas so as to increase the wing loading to the greatest possible degree. And this made launching difficult; it was necessary to throw the models across the starting line.

XUM

A Model of the U.S.S. Akron

by JAMES SMYTHE

A flying model of the dirigible Akron that will appeal to model builders who wish to experiment outside of of the model airplane field.

IT ISN'T often that the average model builder tackles model dirigibles, but there is no reason why he shouldn't for there are no really difficult tricks connected with the job. With the exception of the toy rubber balloons that are employed as "ballonets," the materials are about the same as for an airplane model, and these balloons offer no objectionable tricks in handling.

Now, you will note that this model is a true "rigid" type dirigible just like the U. S. S. Akron that it is copied from, that is, the hull is composed of stiff fairing members that maintain the streamline outline of the hull against the wind pressure, and also afford a means of hanging the gondolas and other loads without direct attachment to the gas bags.

In the model, the hydrogen gas is contained within toy rubber balloons of the type that you buy from a street vendor. The hydrogen, being lighter than air, overcomes the weight of the model so that it will float free or nearly free without any other force acting. The balloons, called "ballonets" in the full size ship, are filled with gas through the bottom of the hull as indicated in the drawing.

Now, the balloons can be completely filled with gas, or another balloon can be added for this purpose, so that the model will float free of the ground or climb, but this is not desirable. Only enough gas should be supplied so that the model is just on the point of lifting, (equilibrium) and no more. With the ship properly balanced, the rubber motor and propeller will do the lifting, aided by the gas, and when the rubber is unwound, then the ship will descend and alight. This is safer than to fill the balloons so that the ship will climb with the gas alone, for then you are likely to lose your model, if flown out of doors.

FROM time to time, the editors of POPULAR AVIATION *intend to bring out plans for various types of flying models that operate on principles different from those upon which the airplane acts.*

So far in this series we have published the plans for a rotor ship and a dirigible. In a coming issue we will print instructions for building an ornithopter or "wing flapper." Watch for it.

Save the cover drawing of this issue for future reference. An early issue will contain full working drawings for the Gee-Bee transport.

Now, the rubber motor used for propelling the dirigible is of exactly the same type used with model airplanes, but we advise you to follow the dimensions shown on the drawings, and also to use the same propeller shown here. The motor stick and rubber are concealed from view in the hull of the dirigible with only the propeller exposed.

After the structure is completed, the rubber balloons are all placed in the hull and the motor is installed, then the dirigible is covered as shown, being extremely careful to make a neat job without wrinkles or slack fabric. This is a more difficult job than covering airplane wings, and to insure tautness, the paper should be tightly shrunk after it is applied.

Hydrogen gas is easily generated by the apparatus shown, and the gas is

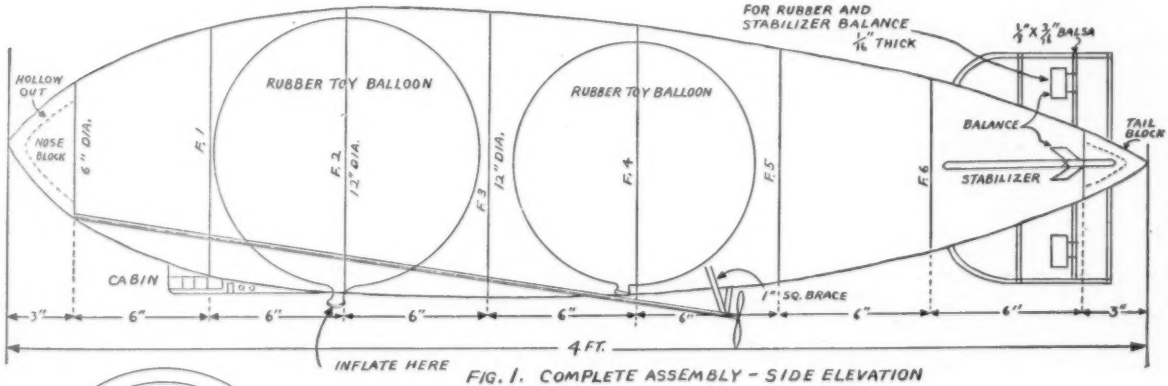


FIG. 1. COMPLETE ASSEMBLY - SIDE ELEVATION

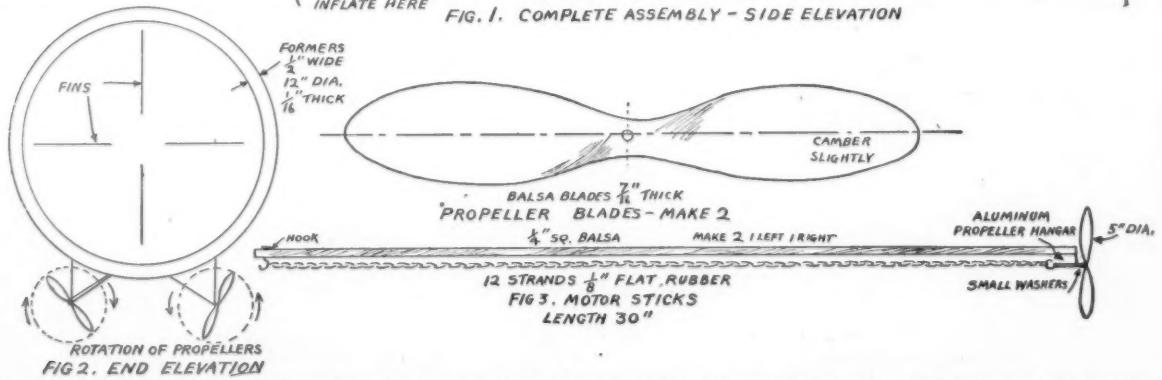


FIG 2. END ELEVATION

FIG 3. MOTOR STICKS LENGTH 30"

The drawing above shows the general layout for the model of the Akron, its power-plant and the propeller. Toy rubber balloons serve as the "ballonets" on this job, the streamline envelope simply acting as a streamline fairing.

then led to the balloons for filling. Great care should be exercised in filling to expel all of the air from the generator and the balloons, because even a little air will greatly destroy the lifting power of the gas. Allow the generator to make gas for a minute or so, discharging the gas into the air, so as to force all air before it. Before filling the balloons, collapse them flat as possible to expel the air, and then completely fill them at least twice in order to work the air out.

Either hydrochloric (muriatic) or sulphuric acid can be used for generating the gas, but in any case it should be diluted with water, pouring the acid into the water—not the water into the acid. About half acid and half water will be about correct. But don't pour the strong concentrated acid into the generator for it will be likely to overheat the generator and break the bottles. Have a dish of diluted ammonia or a solution of baking soda in water close at hand.

The moment that you get any acid on your hands or clothes, apply the ammonia or soda solution to it to avoid burns. These acids will blister the skin and burn holes in cloth, even when diluted.

The structure of the dirigible is shown so plainly that it is not necessary to enter into a lengthy description of the construction here.

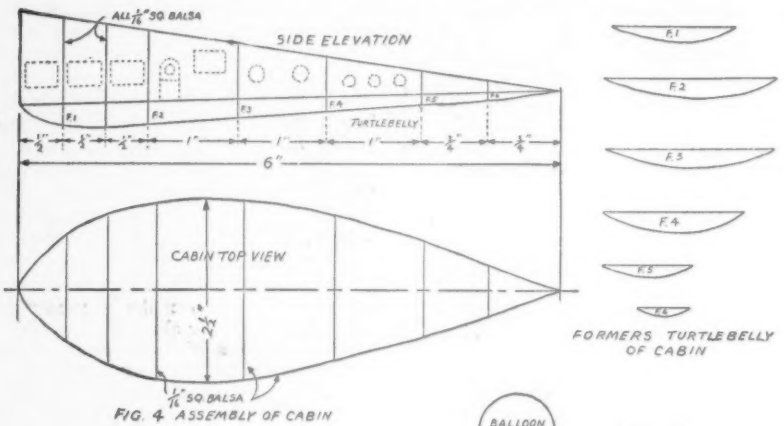


FIG. 4 ASSEMBLY OF CABIN

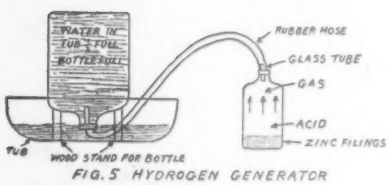


FIG. 5 HYDROGEN GENERATOR

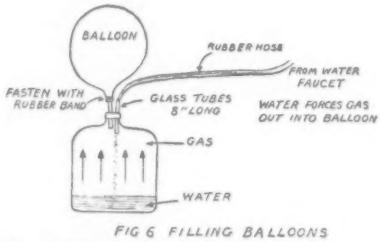


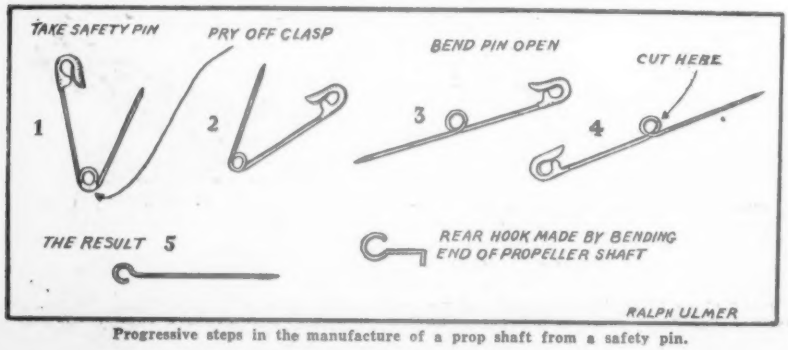
FIG 6 FILLING BALLOONS

Details of cabin and gas generator for the model dirigible. Note the generator carefully.

Safety Pins for Prop Shafts

RALPH ULMER, 2532 Glenwood Ave., Toledo, Ohio, has sent in a novel idea for a propeller shaft, and not only that, but he illustrated the idea very cleverly by showing each step progressively so that the operations are easily followed. The drawing shows the construction so clearly that further description is hardly necessary.

By making a few minor changes in the process, it would also be possible to construct a rear hook and shock absorbers from the useful safety pin. And now for a raid on the safety pins!



Progressive steps in the manufacture of a prop shaft from a safety pin.

Cover Design

The cover of this issues features the new Gee Bee Transport C-8, designed to carry 7 passengers and a pilot. It is now under construction by Granville Aircraft Corp., Springfield, Mass., but has not yet been test flown. Adapted after the famous racing Gee Bee Supersportster, the Transport C-8 is to be powered with a 700 h.p. Hornet which will give it an estimated top speed of 225 m.p.h. and a cruising speed of 190 m.p.h.

The similarity of the transport and the racing plane is noticeable at first glance, for the transport carries the word "Gee-Bee" from nose to tail. Just how this idea will work out in commercial service is not known, but it is likely that the body form will be quite effective.

WANTED!

POPULAR AVIATION will sponsor an international contest to discover the world's finest model of the new Boeing Transport No. 247. The prizes to be offered are sensational—far grander than anything ever offered before in the history of model contests. Everybody welcome; no complicated entrance requirements. Full announcement next issue, on sale Sept. 10th. Watch for it!

Breaks Gasoline Model Record

MAXWELL B. BASSETT, Oaklane, Philadelphia, Pa., is shown beside his record breaking gasoline motor driven model. Bassett's model, powered with a 1/10 h.p. gasoline engine, stayed aloft for 22 minutes which is some duration as powered model flights go.

There is nothing very fancy about this ship. It is simply a monoplane of the parasol type provided with a "stick type" fuesalge. The main wing is given a slight dihedral, starting from the center, and then the wing tips are given additional dihedral as an aid to stability. These elevated tips also serve a useful purpose in adjusting lateral trim against the torque of the engine. Stability with a powered model, owing to the greater torque, is more difficult to attain than with a rubber motor.

Maxwell B. Bassett and his gasoline model.

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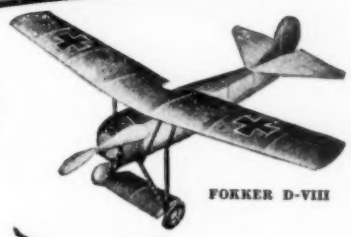
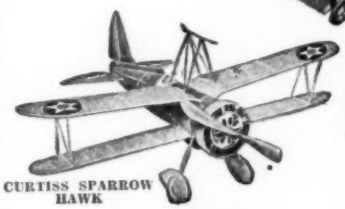


FOKKER D-VIII



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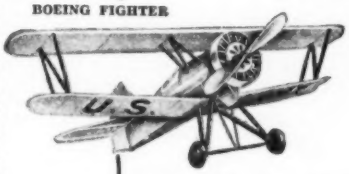
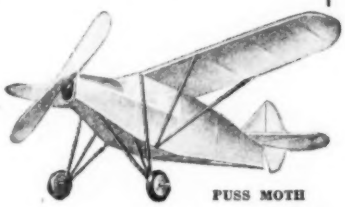
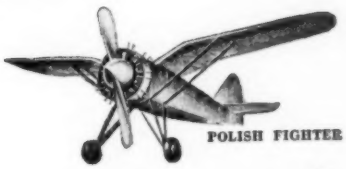


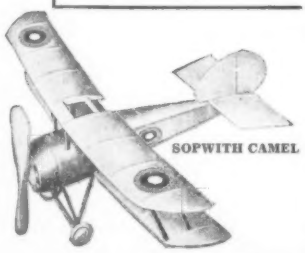
MONOCOUPE



PUSS MOTH



POLISH FIGHTER



SOPWITH CAMEL

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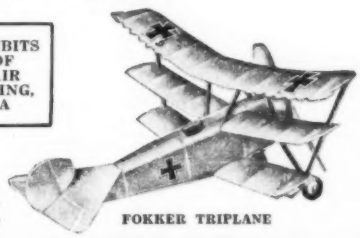
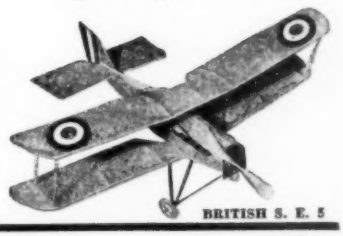


FOKKER TRIPLANE



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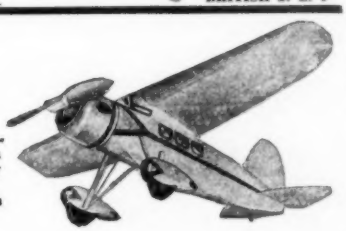

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Engines

(*Continued from page* 172)

in the plans being followed. A cowling job will either enhance or ruin the appearance of a home-built plane. With an air-cooled in-line type engine, the cowling must serve a dual purpose—streamlining, and directing the air flow so that all cylinders are cooled uniformly. The Church and Heath planes furnish an excellent example of this type of cowling. The only way to make a well-fitted cowling is to "tailor" it to fit your installation, seeing that the parts go together perfectly without buckling. It should be designed so as to eliminate as much turbulence as possible without interfering with the cooling process. Louvres should be provided to direct an airstream around the crankcase for cooling the oil. Others should be cut in the rear part of the cowling to allow heated air to escape. With a water-cooled engine, you can make a tighter fitting job of the cowling, but ventilation for the crankcase must still be taken care of. Finally, the cowling should be so constructed that it is readily removable, and the fasteners should be safetied so there is no danger of any of the cowling blowing loose in flight.

Practically all lightplanes employ gravity feed for the fuel system, which is the simplest and most foolproof of any, the tank usually being located in the center section of the wing. Oil tanks are usually installed in the cowl behind the fire-wall. It is a safe policy to install a reserve gasoline tank and fuel line, which can be switched on in case the main system fails. Never use rubber tubing in any of the fuel or oil lines. Flexible metal hose or annealed copper tubing should be employed. If the lines are of considerable length, they should be supported at one or two points by some sort of clips to protect them against vibration as much as possible. In center-wing jobs especially, make sure the carbureter is far enough below the gas tank to insure a good flow when the ship is nosed up at the maximum angle. It is a good idea to install a strainer, with a sump to catch water, at the outlet of the tank, though most carbureters are fitted with strainers. Install a gasoline shut-off valve in the line as far from the carbureter as possible and within easy reach. With a wing tank, this valve can be placed right at the tank, over your head. Here, it will provide the maximum of safety if the line happens to spring a leak.

The oil tank must be located above the level of the pump, or the pump will not prime itself, especially in cold weather. For the typical lightplane, which seldom carries a gasoline load of over ten gallons, an oil tank of one gallon capacity will be adequate.

An oil temperature gauge should be installed. If your engine has no accommodation for one, though most of them have, you can fit one to the outlet line, next to the engine, by using a "tee" pipe fitting, screwing the thermometer into one end of the fitting instead of the side. In this position, most of the thermometer will be immersed in the oil. If it can be avoided, don't allow the thermometer pipe to be exposed directly in the air stream, as this would lower the reading.

The next step is the job of hooking up the engine controls, something that should be given careful attention. The throttle and spark should operate with no binding or sticking through their full range of motion. Be sure that there is no possibility of any bellcranks being thrown past their dead center, or working loose. The rods should be supported by suitable guides to prevent bending. As a general rule, the throttle should be about half closed when the engine is running at the normal cruising speed.

After the tachometer, choke, and oil pressure gauge have been fitted, the propeller is ready to be attached, completing the installation.

It is essential that the propeller be clamped absolutely *tight* on the shaft.

END.

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Controls

(*Continued from page* 160)

the past year or so this conviction has been registered in the mind of almost every honest aviation enthusiast with whom I am acquainted. Several of the commercial aviation potentates have let the cat out of the bag by admitting that "they do not think it would be a good idea to have a lot of private airplanes flying around since they might be a source of danger to planes flying the commercial airways."

Applying this same logic to the highways, all private automobiles should be scrapped because they interfere with the buses. Fortunately the automobile business grew so fast that the red tape experts had no chance to stifle it although they made a few dumb attempts in the way of laws, defining which street you could drive on so that automobiles would not interfere with the street-car business.

If the rising generation in America want airplanes they will have to fight for the right to build and fly them since the present tendency, both as to National and State laws, is toward making it absolutely unlawful and impossible to imitate the birds except by the very dull process of buying a ticket for a ride on one of the transports, and I don't call that flying.

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ALTHOUGH Commercial Aviation is one of the very few industries that have grown in spite of the depression, experts agree that it is still in its infancy. A few years from now every town will have its air port or flying field. Air lines will cover the country like the railroads do today. Aviation is due for a big BOOM! It offers a lot, a great future, to men who train themselves for a place in it.

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Aero-Sportswomen

(*Continued from page* 176)

Atlantic fame, Commander Weems, authority on navigation, Dr. Alison Reppy, president of the American Academy of Air Law and Assen Jordanoff, the Bulgarian pilot. The guests and speakers were introduced by Mrs. U. S. Grant McQueen, vice-president of the organization.

The W. N. A. A. has 19 active units in the U. S. and it was announced by Mrs. Clark Stearns, president, that a unit has been formed in Nome, Alaska. The object of the organization is to make a united effort to cooperate, aid and effect any betterment relative to aeronautics. One of its chief activities has been the annual air mail campaign, which has done much to promote increased and understanding usage of this important branch of Government service.

Miss Nichols made a very strong plea for the organization to foster public confidence in women pilots.

"I have been making a survey," she said, "and there are quite a number of women flyers who have passed the highest tests, who have had years of experience and are qualified to hold any kind of a job—but there are no jobs!

"Women haven't enough confidence in women," she continued. "And this organization will be doing a real service if it will encourage the women travelers to feel that they are safe with a woman pilot. Not that I am advocating that women should be in charge of a transport ship, but there is no reason why she could not be a co-pilot."

* * *

THE editor of this column was especial happy to hear the W. N. A. A. go on record for favoring the use of the term aviator, instead of axiatrix—which for some reason had always annoyed us exceedingly.

We are also ready to indorse the organization's choice of Mrs. George Green, Dayton, Ohio for President next year. Her quiet dignity and clear thinking would be an asset to any organization.

* * *

WE ARE glad to see that one more barrier has been lowered to women flyers.. Namely, the Bendix Trophy race, which is an annual feature of the National Air Races.

The decision to allow women to compete was made only three weeks before the race, which did not allow sufficient time in which to prepare for such an important and grueling test. However, Ruth Nichols and Amelia Earhart entered the race but both of them were forced out of the competition by engine trouble.

"I lost 300 r.p.m. just out of Amarillo, Texas," Miss Nichols said "and you can't imagine how slow 140 miles per hour can seem, after flying two-thirds the way across the continent at 200 or better."

* * *

MAE HAIZLIP won the fifty-mile closed course Aerol Trophy race at the National Air Races. She flew the Wasp-powered Wedell-Williams racer in which her husband, Jimmy Haizlip, won the Los Angeles to New York Bendix dash last year.

Mrs. Haizlip's average time for the course was 168.216 miles per hour, and her prize was $1350. Marty Bowman collected $750 for winging home in second place at 161.708 miles per hour. Gladys O'Donnell took third and $450. Henrieta Sumner, who won the Annette Gibson race in June, came in for fourth place and the $300 that it carried.

* * *

"GO WEST young man," might be feminized to fit Helen McCloskey, 23 year old amateur flyer of Pittsburgh, Pa., who was the only woman entered in the American Air Races held in Chicago. But we are proud to say that Helen upheld the honors by nosing out five men contestants to place second in the Atlas Brew Trophy race.

END.

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POPULAR AVIATION 608 SO. DEARBORN ST. CHICAGO, ILL.

Model Dept.

(*Continued from page* 190)

other ribs to this one. When all this is dry shape and sand to smoothness.

AILERONS

The ailerons on this ship set off the main wing ⅛ inch and are a separate unit entirely. All the aileron is just a piece of 1/32 inch thick sheet balsa cut to shape as shown on the plans, and the supports are of the same stock.

PROPELLER

The flying propeller is cut from a propeller block, as shown with a decided camber.

The scale propeller is rather complicated but with a little patience it will end up as a beautiful job.

PAPERING

Now it pays to be very careful when you are doing the papering, because if it is not done neatly, the model will be disappointing.

First, I would start with the fuselage. Use small pieces of tissue (WHITE) and paper between one or two formers at a time, using banana oil for an adhesive. Start from the nose and works towards the tail. As you paper the front part of the model, take the center section with it.

Next paper the tail sections.

Now the wings. Just take one curve at a time, otherwise the paper will wrinkle.

Lay the papered parts of the model on your work table and take a small atomizer or a hand spray and spray a fine mist of water over all the papered surfaces. This will tighten up the paper a considerable degree. If you use too much water you will ruin the job.

After the paper has dried out, give the surfaces two coats of banana oil and let it dry.

TRIMMINGS

On the rudder, a small "Texaco" label should be placed, which will have to be hand drawn unless you can go to a filling station and obtain one there. Also print in red letters on the rudder —X12265.

Cut an arrow out of red tissue for each side of the fuselage and also cement another "Texaco" label on each side, besides printing "Sky Chief" on each side of the label.

Cut large red letters out of tissue also, for the right main wing and banana oil them in place.

On the left wing you will have to draw the "Texaco" label on some kind of thin paper and banana oil it in place. It is about 2¼ inches in diameter.

GENERAL ASSEMBLY

First cut a hole in the under side of the wing where the paper has covered the wheel spat supporters, then spread plenty of cement on the spats and put them in their positions. Next cement the tail wheel in place using plenty of cement.

Now cement the rudder on, again using a lot of cement. Be sure it is exactly upright. Now the elevators—*IMPORTANT*, Be sure to set the forward part of both elevators 2 or 3 degrees higher than the after part. This insures your lateral stability. Also be sure that they are parallel with the work table when the plane is setting on it.

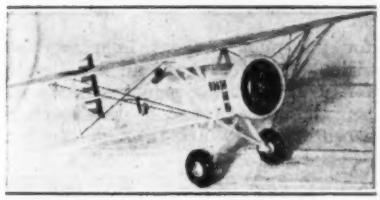
Apply plenty of cement to each wing and hold it onto the center section until it has set thoroughly. Also cement the ailerons to the upper surface of the wing at the x-x marks on the plans.

Measure off enough 1/32" x ⅛" rubber to make six strands for the model, and string it in place with a wire hook.

Well, fellow builders, all you have to do now is to wind 'er up about 150 to 200 turns and launch 'er and watch a keen speedy flight of 30 seconds to 1 minute.

END.

Curtiss Sea Hawk P3A



24" Span, Weight 1¾ oz., Flies 900 Feet

Set includes 3" celluloid motor, aluminum motor plate and drag ring, balloon celluloid wheels with silver discs, printed instrument board, fuselage, wing and rudder insignia, aluminum pilot's seat, dope, glue, drawing and all materials. Const. Set $2.50

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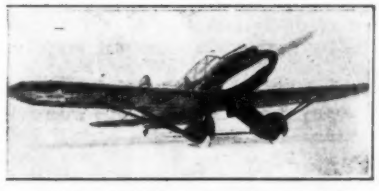

24" Span, Weight 1 oz., Flies 675 Feet

Set includes semi-finished wheelpants, glistening hollow metal exhaust pipes, strong aluminum wheels, two color dopes, glue, wing and rudder insignia, U. S. Army lettering, detail drawing, ribs, formers, etc., printed on balsa. Const. Set. Postpaid $1.75

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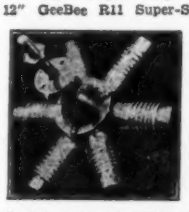

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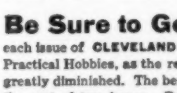

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Junior Ace

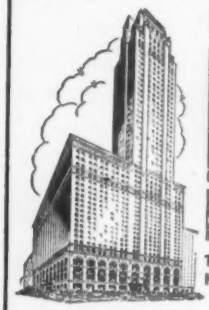
(*Continued from page* 184)

so the right action on the stick or rudder pedals gives you the correct movement of the control surfaces, that is, when the stick is pulled back the elevators should pull up. When the stick is pushed to the right side of the cockpit, the right aileron should move up and when the right rudder pedal is pushed forward the rudder should swing to the right. See that all of the cables run free and that they do not touch any member in the fuselage or wings.

I have not gone into a great deal of detail regarding every little part for I believe the plans are clear and you should not have any trouble, however, if something is not quite clear to you don't guess at it for I will be only too glad to answer any questions you may have. Just drop me a line and send a self addressed stamped envelope to the Corben Sport Plane Company, Madison Airport, Madison, Wisconsin.

END.

When You Come to the



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Pusher Plane

(*Continued from page* 161)

maneuvering of his machine. Leading characteristics of the new machine are:

Wing spread.....44 ft. 4 inches
Length .....25 ft. 8 inches
Height .....8 ft. 10 inches

Full results of the trials have not yet been officially announced and therefore remain among the secrets of the French military aviation department, but in several trials she took off from the ground after a run of less than 150 yards, which is remarkable for a high-speed pursuit ship, and what is still more remarkable, landed after approximately the same amount of run.

At over 10,000 feet she attained an air-speed of 230 miles an hour with full equipment, machine guns, ammunition and a full tank included, and in a climbing test, reached 30,000 feet in a time that clipped several seconds off the best record yet made by any fighting machine.

END.

Corsair

(*Continued from page* 154)

for the pilot without impairing his vision. The four guns all fire directly forward, two being mounted in the upper section, and two in the fuselage, synchronized to fire through the propeller circle.

These guns are electrically operated with selector switches so the pilot can cause any or all guns to fire when the control stick trigger is pressed. Standard A-3 bomb racks are carried under the lower wings with controls in the pilot's cockpit. As in the standard two-seater "Corsair," provision is made for ready interchange of wheel type landing gear with singe-float seaplane gear.

In its trials at Rentschler Field, the V-80, equipped as a landplane with full military load including a normal fuel load of 130 gallons, showed a top speed of 190 miles an hour, comparing favorably with the finest single seaters in service.

END.

Flexible Wings

(*Continued from page* 170)

The vanes of the flight feathers, therefore, form a thin highly elastic surface in the rear part of the wing which corresponds to a flexible trailing edge in an airplane wing.

Pettigrew, Marey and other investigators have shown that the efficiency of the bird wing is due to the resilience whereby the wing is enabled to store up elastic deformation energy which is later converted into a forward acting component. This enables the bird to progress forward without apparent muscular effort and without the aid of raising currents of air. This action persists just as long as the air is eddying or turbulent, but ceases when the air motion ceases.

In other words, the energy of an air pulsation impacting on the wing momentarily bends the feather upwards, and after the passing of the impulse, the elasticity of the feather shaft returns into place, creating a propulsive force that acts in the direction of flight. Further, the camber is reduced under the impact reducing drag.

Duplication of bird wing action introduces many difficulties into a mechanical device, but in the Dereimer plane built under the Van Vliet patent it has given very satisfactory results. The wing of this plane is flexible throughout and is capable of flexing upwards and laterally as well as flexing helicoidally. When flexing laterally, it assumes a dihedral angle. While flexing in the other direction it produces the equivalent of "washout" or variable incidence near the wing tip. The wing profile presents a double cambered front portion that merges into a flexible resilient after portion.

One of the most remarkable facts in regard to the construction is the fact that not one member of the Dereimer wing is rigidly connected to any other part of the wing. The wing spars are mounted on the center-section longerons by rubber lapped bearings so that the spars can assume their natural elastic curve without interference at the points of support.

The ribs are also mounted to the spars in rubber bearings, so that the spars are able to flex independently without imposing any stresses on the ribs during flexure. The ribs are also able to rotate slightly about the spars.

The spars and front portion of the

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ribs are of spruce with the rear ends of the ribs made of ash to attain a greater degree of resilience in the trailing edge of the wing. The spars are made of spruce, of uniform square section except at the ends where they taper down in plan view.

One of the great difficulties with a flexing cantilever wing is to adjust the spar size. If too heavy, it will not flex. If too light, the spar will break. The pure cantilever type has therefore been discarded in favor of the four-point support structure, that is, the spars have two additional supports—one at either side of the fuselage about six feet out.

These supports are now provided by two chrome-molybdenum steel tubes placed between the spars inside the wing and fixed in the center-section bridge over the fuselage. Diagonal struts to the bottom of the fuselage are also provided whereby the tubes and struts form a fairly rigid structure. Vibration in the light struts is prevented by the jury struts.

The extremities of the struts fit into slotted apertures of steel bridge members which connect the front and rear spars. They are mounted thereon by means of rubber bearings similar to those employed in the ribs. Thus, when the spars flex laterally upward, the bottom of the slots will finally come into contact with the tubes and prevent the spars from flexing any further.

Thus, by means of this four-point support for each spar, part of the load is carried by a cantilever beam while the remainder of the load is carried by an externally braced beam. The bending moment can be controlled so that the maximum moment will always occur at the outboard support, whereas the moments at the central portion of the spar will actually decrease for an increased load. Thus, between the supports, the spars automatically acquire an increasing safety factor.

Although the patent calls for a wing warping device which is effective at high speed, ailerons have been used on this particular wing because of the low horsepower and the low speed of 115 m.p.h. The present plane has an engine of only 60 horsepower. The span of the wing is 30 feet and the chord is 5 feet which gives a net area of 147 square feet.

When in the air, the flexed wing gives the curved equivalent of a 164 degree dihedral angle, each half of the wing deviating from the horizontal by 8 to 10 degrees. It maintains resilient contact on the air which contributes to the remarkable lateral stability of the plane and which is further enhanced by the helicoidal washout of the entire wing.

A novel substitute for drag bracing is made because the conventional drag bracing would interfere with the action of the spars. This consists of a series of diagonal plywood strips connecting the spars on the top and bottom. The top strips run in one direction while the bottom strips run in the other so that the spars can flex vertically but not in a fore-and-aft sense. The ailerons float between the ends of the cap strips and are connected with the rear spar by a similar arrangement of diagonal strips so that the somewhat rigid front edge of the aileron is not interfered with by the flexing of the main structure.

There is a disparity between the actual flying tests of the full size wing and the wind-tunnel tests conducted on a rigid model, the full size speed actually being 115 m.p.h. while the wind-tunnel tests indicate a maximum of 88 m.p.h. Level flight with the present flexible wing can be comfortably maintained with less than 10 h.p. at 53 m.p.h. while with the original rigid Clark "Y" wing, the low speed of 53 m.p.h. could only be maintained with 16 h.p. This speaks eloquently of the efficiency displayed by the flexible wing in actual flight. A rigid wing having the same profile as the flexible wing required an expenditure of 20 h.p. at 53 m.p.h.

RELATIVE PERFORMANCES

Items	Flexible Wing	Rigid Clark "Y"
High-speed test	115 m.p.h.	97 m.p.h.
Angle of attack	0.0°	1.5°
Climbing rate	980 f.p.m.	600 f.p.m.
Take-off, calm air	100 ft.	200-250 ft.

The test flights were made at altitudes varying from 2,000 to 5,000 feet at the Wayne County airport, Detroit, Mich. The wing was originally designed for a speed of 200 m.p.h. with a 200 h.p. engine, but as no such engine was available at the time, the flights were made with a 60 h.p. plant without changing the wing profile to correspond to the lower speed.

The flexible wing is extraordinarily stable in the air, the wings assuming a dihedral of about 10 degrees. The trailing edge works up and down periodically in rough air from ½ to one inch. When nosed up to the stalling point, the ship automatically noses down and then flattens out again, repeating the performance until the pilot reduces the angle of the elevator.

END.

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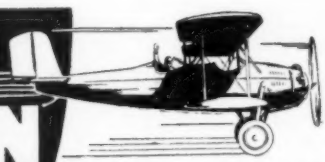

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Southern

(*Continued from page* 180)

Transcontinental & Western Air, Inc., in a recent address at Birmingham, Ala.

Mr. Hay said that the first commercial business was carrying mail, then passengers and now merchandise. The saving of time was the principal objective in quick air transportation. With charts he showed the progress of the air transportation business.

As to the costs of postage, he asked a question that it was hard to explain, why, that additional weight of letters carried so much higher postage.

A New Aviation School

A SCHOOL of aviation for Mississippi State College, to be one of four in American colleges, was approved recently. Under the project as adopted by the trustees, two four-year courses will be offered, one in commercial aviation to be under the business administration, the other in aeronautical engineering in connection with the engineering school.

"Practice shops" for the ground school have already been donated by the United States army, Mitchell Robinson, business manager at the school said, together with necessary engineering equipment.

A Surpassing Airport in Ponca City

EVERETT TAYLOR FIELD, Ponca City, Okla., municipal airport, has the reputation of being one of the best equipped and most modern in every respect in the entire southwest.

It was equipped to meet the requirements of the Department of Commerce and also the Postal Department for daily mail service furnished by the United Air Lines.

Everett Taylor Field was named for Lieut. Everett Taylor, one of the two Oklahomans who were killed in the air service during the World War. The present field was dedicated on July 4, 1930.

The site for the new permanent airport was selected during 1928. It is a 160-acre site, two miles northwest of the city. It has natural drainage that is entirely adequate even during the worst weather. Immediately, arrangements were made under the direction of E. E. Bennett., to build a fireproof hangar, which was completed in time for dedication of the field on July 4, 1930.

Following the completion of the hangar, the field was leased by the city to the Continental Oil company for management. This arrangement is still in force. The Continental maintains several planes here all the time. A feature of the airport is the fact that it is being paid for without any direct taxation money as funds for this purpose are allocated from the profits made by the municipal water and electric plants.

In addition to the entire field having natural drainage, it has about 1½ percent. slope from the landing areas to the border of the field. The runways were planted immediately to native grass, establishing a heavy sod. White stone markers, set level with the ground, line the runways.

The main room of the hangar is 120x106 feet in dimensions, entirely free of obstructions and capable of housing 12 planes of average size.

Within the hangar are three workshops, one of which is used by United Air Lines for repairs on its ships. At each of the four corners of the hangar are two rooms, each 20 x 20 feet. Every modern electrical equipment has been installed, and all controls are operated electrically.

On the roof is mounted a miniature plane which indicates the direction of the wind and also controls automatically the lights on the switchboard and the star. This, an 8-pointed star with vari-colored lights at the different points, indicates the exact direction of the wind, so that the operator, may turn on the exact battery of floodlights needed by a flyer.

A ceiling indicator also is mounted on the roof and the operator may learn the exact height from the ground to the lowest clouds at night by turning on the ceiling indicator and reading the gauge. There are 52 boundary lights all told. At the head of each of the 8 runways is a bar of green lights, approximately 500 feet in width, which indicates each separate runway distinctly. The shortest runway is 2,640 feet long, and the longest is 3,400 feet.

One noticeable feature of the field is that there is no red or obstruction light. The field is absolutely free of all kinds of obstructions. All wires are underground. The revolving beacon light has a beam candle power of 5,000,000. From a height of 15,000 feet, flyers may see at night a lighted "PONCA CITY." There is also a ceiling light, informing incoming pilots of the height of the clouds; also an electrically lighted wind tee, the small plane above mentioned.

A stone circle, 150 feet wide and painted white, marks the center of the field, while a continuous smoke column across the airway is a guide for pilots.

New Runways to be Built

PLANS for constructing three hard-surface strips on the runways at the municipal airport, Oklahoma City, Okla., will be included in next year's budget, according to Albert McRill, city manager. The program will include one-half mile strip on the east and west runway, a similar strip on the north and south runway and each short runway leading to the terminal.

Honors Mrs. Curtiss

HONORING Mrs. Lua Curtiss, mother of the late Glenn H. Curtiss, aviation pioneer, Major General Benjamin D. Foulios, Washington, chief of the army air service, presented her with the Distinguished Flying Cross at a meeting in Miami, Florida.

Oklahoma Backs Wiley

BUSINESS and professional men of Oklahoma City raised $5,002.50 to defray the expenses of Wiley Post on his solo flight around the world.

The contributions were made by 45 persons and ranged from $10 to $2,600. The latter amount was given by John Kroutil, Yukon, Okla., miller, who has engaged Post to fly himself and a party to Washington on several occasions.

Ardmore Again in Shape

ARDMORE, OKLA., without airplanes for many months, is again ready to take the air.

Ben Scott, Jr., licensed transport pilot, flew home in "Miss Ardmore" the first airplane to be established in this city since the disastrous fire which destroyed the local hangar.

Woodring Field

THE municipal airport, Enid, Okla., has been renamed "Woodring Field" in honor of Lieut. Bert Woodring, last of the army's famous "three musketeers" of the air, killed at Dayton, Ohio last January.

His widow, Mrs. Louise Woodring of Port Huron, Mich., attended the ceremonies and presented a large portrait of the flyer to the city.

An A-I-A Rating

THE municipal airport at Tulsa, Okla., has been issued an "A-1-A" rating by the department of commerce. This is the highest rating issued by the government and outranks that held by the municipal air terminal here.

Reduction of Fares

REDUCTION of the fare over the Transcontinental and Western Air, Inc., between Oklahoma City and St. Louis, Mo., one of the company's speed runs was announced here recently. The new fare will be $22.95 compared with $33 previously. A 10 percent reduction also is offered on round trip tickets. The reduction was a "point to point" cut and does not affect any other points upon the national network.

Revises Operation Schedule

DUE to heavy increases in traffic since the recent rate cut, Braniff Airways, Inc., has revised its schedule of planes between Oklahoma City, Kansas City, St. Louis and Chicago.

The schedule change gives Oklahoma City three trips daily to Chicago.

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Airy Chat

(*Continued from page 150*)

I'll admit that some of this is due to low production volume with airplanes, but even if this job were hand-carved it should hardly reach this price. I am beginning to see now, just what is tying up private aviation.

Airplane manufacturers have become believers in the delusion that they must charge a whole lot for their product, just because they have not the demand volume of an automobile factory. If they would temporarily lower the price, I am of the opinion that demand would quickly make itself known.

It is essential that the manufacturers of lightplanes build the engine as well as the plane itself. No plant can possibly put out a ship for $1,000 or less and still pay the outrageous prices asked by the engine manufacturers. I see no reason at all why one of the little kickers employed for a lightplane cannot be produced for $200 or less.

* * *

THERE'S a bird down in Tennessee who arises to the occasion and proclaims himself as follows:

A school term of 50 hours is a long time in the life of the beginner birdman. At $15 per hour it is still longer. I just got up to the point where I was already to sally forth and operate a three-seater for my own pleasure, when —bam—I was faced with 30 hours more.

Now, all the wise birds will chirp up and yelp, "Oh, isn't that man awful? Why, certainly he shouldn't be allowed to carry a sweet confiding innocent passenger until he has had at least 50 hours, and take it from me kid, it ought to be 200 hours."

Well, all I have to say further runs to the effect that hours are not the whole standard of measurement of ability. I note with interest that commercial pilots with thousands of hours are still pulling off pin-headed performances and wrecking themselves and passengers far more scientifically than a 10 hour pilot could do the job. Some guys will learn in 20 hours that others can't learn in 10,000 hours—so why the hour limit?

What you say is perfectly true, particularly in respect to ability versus hours. And I'll go still further and make the remark that the old personal factors of self-discipline and mental stability are worth far more than either hours or flash flying ability.

THE new course in aviation, aeronautics, flying or what have you, starts in this issue. Its appearance is the result of many letters requesting information of this sort, so here we go. After we describe the characteristics of air in this issue, which is admittedly a dry subject, we will enter into more interesting phases of flight treating of wings, tails, lift-drag, wing-sections, performance factors and all the rest of it.

The author has attempted making this as simple as possible, yet at the same time, so that it will cover important matters with a fair degree of thoroughness. If you fellows are interested in flight principles, you'd better tune in on this first lesson and follow the subject all the way through.

* * *

THEN there is Robert Klink, Olean, N. Y., who has quite a good suggestion for a new department in P. A. If any of you fellows think that this interchange of ideas and data would help things along, just write in and tell us. Here's the idea.

I am going to suggest an aviation notebook contest. I know that there are quite a few fellows who have very nice and informative notebooks who would like to show them and get data for their own use from other readers.

This might easily be incorporated into P. A., if we were certain that the stuff would keep coming in. There are amateurs all over the country who have a wealth of original ideas.

* * *

THERE is something new in aviation. It is the "dinky", or a four line poem of two words per line. This has been brought to our attention by Palmer Rommereim who sends us two samples with which to illustrate his views. So, away we go with the dinkys —hope you'll like them.

No. 1
Bum Pilot
Busted prop
Sure spoiled
Farmer's crop.

No. 2
Leveled off
Too high
Landed like
Custard pie.

Well, how do you like dinkys? Maybe this will inspire some more of our poets to create other dinklespiels. But, please remember, regular poetry doesn't go in P. A. Only limericks, dinkys and such-like.

ONE of our eastern correspondents sent a story in which the personnel was slightly jazzed up. This was a short notice printed in the May issue and our attention was called to it by Clifford C. Grimm, Mespeth, L.I., who writes as follows:

The article is partially incorrect inasmuch as Stuart Frazier was not a passenger in the plane that cracked-up and it was not piloted by his son but by myself.

I am merely writing this letter to clear Stuart Frazier's son of a crack-up for which he was not responsible and to clear myself of hopping passengers on a student's permit.

O. K. So much for that. I hope that Messrs. Grimm and Frazier will have better luck next time and also that our correspondent will have better luck in getting names right.

* * *

EVEN though the L. A. A. has not yet materialized as an organization, we have had some unofficial encouragement from the Department of Commerce that may make it possible for P. A. to bring about the desired reforms unaided.

* * *

SOMEONE at the Airshow admired Strohmeyer's model Sikorsky to such an extent that he decided to take it home with him where he could see it without paying admission. Anyway, this fine model was stolen.

* * *

Well, auf widersehen, adios, adieux or what have you? Same place next month. J. B. R.

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Magnetos, 4 cyl. Cirrus Scintillas, like new, $25. Suitable Ford A conversion.
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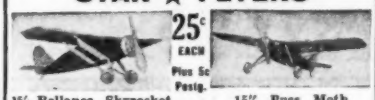

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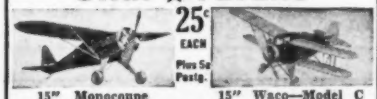

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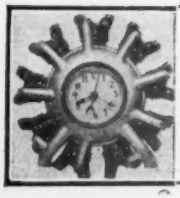

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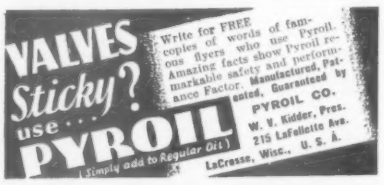
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For Classified Advertising
See page 208

Q & A

(*Continued from page* 178)

QUESTION:—A. B. McComber, Fresno, Calif. *What is meant by the term, "Sloppy rigged plane?"*

Answer:—A SLOPPY rigged wing is a wing having slightly loose stay wires, this looseness being effective in taking up sudden shocks due to wind gusts. The slack wires also assist stability to a limited extent.

* * *

QUESTION:—Harvey Godfrey, Indianapolis, Ind. *I noticed in the August issue that the Arup Flying Wing has a landing speed of about 23 m.p.h. How is such a low landing speed obtained?*

Answer:—THIS is largely due to the low wing loading which is only in the nature of 3.8 pounds per square foot. This is much lower than the conventional loading of 5 to 6 pounds per square foot with ordinary lightplanes.

* * *

QUESTION:—H. H. Piper, Tampa, Fla. *What is the most stable wing section known at the present time and what is its general form? Is it suitable for lightplanes?*

Answer:—THE center of pressure travel of the M-6 wing section is practically zero through a wide range of angles and we consider it a good wing for many types of lightplanes. It has a double convex top and bottom surface.

* * *

QUESTION:—Rudolph C. Endes, Phenix, Ariz. *I have heard that there is a simple method of determining the position of the low pressure area or a cyclone from the direction of the wind. Please describe.*

Answer:—WHEN facing the wind the cyclone or low pressure area is at the right. The rotation of the air about a low pressure area is left-handed or anti-clockwise, hence this simple rule for locating the cyclone.

* * *

QUESTION:—Ralph S. Smith, Brooklyn, N. Y. *What is meant by the displacement of an engine, that is, when the figure is 277 cubic inches or a similar figure?*

Answer:—THE displacement, or rather the "piston displacement," is the volume swept out by all of the pistons in one complete revolution. This would be the amount of air moved by the pistons in one revolution, when the displacement is 277 cubic inches, the pistons of this engine will pump 277 cubic feet of air per revolution without valve or clearance losses.

When the piston displacement is multiplied by a number, depending upon the type of engine, the product will give the maximum horsepower.

Squalls

(*Continued from page* 154)

ing altitude we again sailed back over the land and finally landed on a ranch near the Mexican border.

There is another classification known as "Periodical Winds" under which come the "Monsoons" of the Indian Ocean and the China Sea, the most famous winds of their class.

Under the classification of "Variable Wind" is the "Simoon" and "Sirocco." These winds blow without any marked regularity as to time and place. Those prevailing on the deserts of Africa and Arabia are probably the most remarkable of this type on account of their extreme dryness and intense heat. In Arabia and on the shores of the Red Sea this wind is known as the "Simoom," meaning hot, poisonous, or dangerous. In South Italy and adjacent districts it is called "Sirocco."

HURRICANES or Cyclones come under the classification of "revolving storms." These cyclones in the Northern Hemisphere are approximately circular in form, with the wind blowing around them in a counter-clockwise direction and with a slight bearing towards the center or low pressure zone as shown in accompanying sketch.

From the source in low barometric pressure areas, the course or track of translation of these storms is approximately as follows. They first pursue a Northwesterly course and gradually curve to the right (Northeast), then dissipate finally in that direction. They vary considerably in size, and may cover half the Atlantic Ocean, or may be only 100 miles in diameter.

The larger the depression, the longer warning we have of its approach and therefore the easier it is to avoid or utilize it. Also, except in rare cases, a very large depression is only associated with violent winds over a comparatively small area, and their rate of translation along a path rarely exceeds 50 miles an hour.

The strength of the wind in a revolving storm is largely dependent upon the distance apart of the isobars shown in sketch as concentric circles. These circles mark the various barometric pressures recorded. The shorter the distance between these isobars, the stronger is the wind.

The right-hand semicircle of the storm is known as the "dangerous semi-circle." The left hand is known as the "Navigable Semi-circle." By means of a barometer and general observations, the path and center of such a storm may be easily avoided by aircraft. It is only necessary that the ship have a good turn of speed, and then in a very short time it can attain a favorable position in the "Navigable Semi-circle." In fact, such a storm can often be utilized to assist the airship in its course.

The cyclonic type of storm does not therefore present a serious obstacle to the airship and should not interfere much with scheduled flight. As a matter of fact, such storms are only an inconvenience at the worst.

Lightning does not present any great danger to an airship. Instances are on record where Zeppelins have been repeatedly struck by lightning with no ill effects. The metal framework of the airship acts as a "Faraday Cage," distributing the electric charge on the entire hull, instantly diminishing its electric or heating effect.

The author's experience as an airship officer of the United States Navy leads him to believe that uncharted electric storms will always remain the airship's greatest danger. This peril, known as a "Line Squall," is the real menace now confronting us and about which complete meteorological data appears to be lacking. This uncanny slinking monster appears with little warning, often in the dead of night, striking a vicious death blow unexpectedly.

It is to the airship what an uncharted submerged rock or shoal is to the steamship, but it is infinitely more deadly, because it is more or less invisible in an uncharted sky and moves with terrific velocity.

AS INDICATED in the accompanying sketch, the center of a line squall consists essentially of a huge stream of rising air current rushing violently upward and another huge stream of descending air rushing violently downward. These opposing air currents form a shearing and rupturing force, which seriously stresses or tears asunder any aircraft caught in its turbulent influence.

Although the violence of these ascending and descending currents in the center of an electric storm may reach an incredible speed, the rate of translation of such a storm mass across the sky in a certain track is believed not to exceed fifty miles per hour. Fortunately therefore, the destructive area of a line squall is compact.

If an instrument could be invented that would quickly detect the direction and center of an approaching line squall, this menace could be avoided by detouring around the disturbance, or at least avoiding the center of the storm. Such an instrument would be of incalulable value to an airship commander, for without it he may be compelled to fly over uncharted regions at a great disadvantage.

Another baffling fact is that very violent electrical storms take place at high altitudes of which there is no indication from the ground. In the same manner, when turbulent atmosphere is encountered at low altitude or on the ground, higher altitudes may be entirely free from disturbance.

These electric storms are also generally confined to certain areas and certain periods of the year. Meteorological observations also indicate that thunderstorms follow a more or less definite track.

IT SHOULD therefore be possible to chart these disturbed areas and also to plot the tracks of the storms, showing the areas immune. If such a chart was available to the airship commander and adequate weather forcasting warnings given, most all of the menace to airship travel would be eliminated.

Observations also indicate that thunderstorms do not travel far out to sea. They may follow a line of islands or cross from one mass of land to another, but they always tend to hug the coast.

The line squall, which caused the loss of America's first rigid Airship the "Shenandoah" on September 3rd, 1925, over Ohio, came upon the ship with little or no warning. The ship was flying at an altitude of about 2100 feet, and had been maneuvering since midnight to avoid electrical storms in its path. All of a sudden a thin dark streaky cloud formed in the distance to the Northward in the light of an ominous moon, and built up quickly to formidable proportions.

The Captain immediately ordered the course changed and headed away from the oncoming cloud. Simultaneously with the Captain's order, the ship began to rise rapidly, caught in a violent gush of rising air currents in the center of the storm. Everything possible was done to check the rise, but neither the release of the lifting gas nor the ship's motors and controls could check the ascent.

At about 6200 feet altitude the rise came to a halt. The ship was then caught in violent descending currents and began falling at the rate of over 1400 feet per minute. Ballast was released to check the violent descent, but the ship—caught in the turbulent center—rolled and tossed violently and continued falling. Again, an upward gust caught the bow of the ship.

The strain was too great for the good old "Shenandoah" to bear. The control car snapped from its mooring and went hurling down to earth with the speed of a bomb, carrying Captain Landsdowne and eight of his Officers and crew to an untimely death. Just as the bow of the ship was forced violently upward, a similar force exerted a vicious pressure on the tail section, breaking the ship at the top and opening her on the bottom. The ship, broken in two parts, was finally landed as a free balloon some hours later by surviving officers and men remaining in the shattered parts. Fourteen officers and men lost their lives in this pioneering adventure.

END.

XUM

Coast Guard

(*Continued from page* 156)

ning seas. "I hope we get up there before dark. If we don't I'm afraid that boy will never survive the night."

THE amphibian reached Cape Canavarel about mid-afternoon. All eyes in the ship strained down into the fuming, crashing sea to glimpse what might resemble a boy in a skiff. Back and forth they flew, circling the area several times. Then between two giant waves they found it. Flying lower they made out a boy signalling feebly with his hand.

"Now to find a boat somewhere that will come to his assistance," returned Von Paulson. But no boat could be found. The "Arcturus" flew to the West, then to the North, to the East, to the South. Not even a fishing boat out in the wild sea.

It was a grave situation. The Coast Guard Patrol at Palm Beach, eighty-five miles away, could never make it before dark. Already it was late in the afternoon and night would settle on these waters in less than an hour. Close examination showed the skiff, a small flat bottomed boat, in bad shape. The wind was shifting to the Northeast, increasing.

If the boy was not picked up before dusk he could not be located again until two or three hours after daylight the next morning. But, would he live through the night? Could that little match stick of a boat weather the fury of a mad night at sea? The Commander reasoned that neither could possibly survive. The only possible conclusion was that if the boy was not to die he must be rescued by plane before dark.

Could the plane effect a landing in the rough seas without damage, without injury? Could it, after landing, pick up the boy and take off again? Commander Von Paulson had to decide quickly whether it was worth risking damage to the plane or allow a boy to die uncomfortably.

The "Arcturus" was a plane constructed for rescue work at sea. The personnel was employed for rescue work at sea. It was their job and as long as that boy in the skiff was even remotely alive, it was their duty to try and save him. So Commander Von Paulson decided to risk it. With clear mind and steady hand he nosed the ship into the strong wind and made a normal landing.

"We seem to be okeh, sir," said Lieutenant Foley to the Commander.

But just then one of the mechanics called from the aft, "Sir, the struts on the left wing-tip float are gone." Then followed two or three sharp, staccato impacts. "The float is banging against the wing, sir," said the mechanic as he looked out from the cabin door.

"Before we can pick up the boy," said the Commander, "we must clear that float." Radio operator McKenzie stripped and dove overboard to do the job. By the time he fought his way through several twelve foot waves to the pontoon, he found the wires carried away and the float drifting clear.

The amphibian taxied to the skiff, picked up the boy, who collapsed inside the plane. So raw were his lips, mouth and throat from the salt air and ocean brine, he could barely swallow a bit of fresh water. His eyes were bloodshot, his face swollen and his body bruised and battered from the waves throwing him from one side of the boat to the other.

THE "Arcturus" took off successfully but in the air further trouble developed. The plywood on the left wing was damaged more than they knew. It began to strip and Commanded Von Paulson could not hold the wing level. Again they landed in the sea. This time the hull wrinkled under the forward spar. Commander Von Paulson tried to taxi toward the Florida coast but was not able to make any headway because of the absence of the wing-tip float.

Finally he stopped his engines and threw out a sea-anchor. In less than twenty minutes the anchor line was carried away and with it, the anchor. The men improvised another anchor, rigged up a pole antenna and prepared for anything which might happen.

Night swooped down out of the slate sky. The rain continued to pound and the waves rocked the disabled amphibian with invisible fists. Fortunately communications were unusually good under the bad weather conditions. Radio operator McKenzie sent out S.O.S. calls as the immediate situation was dangerous if not critical.

McKenzie's instruments tick tacked on through the night. Another Coast Guard plane was leaving to rescue them. Patrol boats already were dispatched from Fort Lauderdale and Palm Beach. If they could only hold out a few hours. Commander Von Paulson felt sure that they could.

The plane's rugged design and fabrication stood the punishment of a furious sea like a fighter in the ring who could take it on the chin and not keel over. The wings remained firm. The hull did not leak. The engine, accessories and instruments were unharmed.

About one o'clock in the morning the ship gave a sudden lurch forward and sped along with uninterrupted progress. Then it struck something that grated under the hull.

"Land!" cried Lieutenant Foley as he looked out and saw a few stray cocoanut palms on a beach, and a primeval jungle directly behind. They had been driven rather comfortably through three lines of surf and beached right inside of Bethel Shoal.

Radioman McKenzie wirelessed the nearest station. They were found shortly by Customs Border Patrolmen. Lieutenant Foley was taken to the nearest telephone where he arranged for salvage of the Arcturus. An ambulance was sent for the sick boy and took him to the nearest hospital for proper care. The boy recovered.

The Coast Guard aviation base at Miami has been in operation only six months, yet its presence is already felt mightily along the entire Florida East Coast. If it had saved but one man from death in the sea it would have fulfilled its obligations to the forces which placed it in this area. But it has done more than that. In a short half a year, it has saved many lives, lessened the anxiety of hundreds along the Coast, relieved the distress.

Back in 1922, a pilot operating a seaplane service between Miami and Bimini, was forced down in mid-ocean with five passengers aboard. Boats passed them by night. Boats passed them by day. And never found them. Their feeble signals, a cry, a white garment, a brief torch, were never seen. After much suffering, the passengers, including three women, all died. The pilot, insanely trying to suck blood from his punctured wrists, was accidentally found by a Coast Guard cutter. He recovered. If the Coast Guard flyers had been established on the Florida Coast as far back as 1922, those five passengers would most probably have been alive today.

END.

Wind-Tunnel

(*Continued from page* 164)

angle of incidence may be determined by dividing Ky by the Kx.

The center of pressure curve should also be plotted. This is always spoken of in terms of per cent of chord from the leading edge. It is obtained by multiplying the force in the C. P. arm of the balance by the length of the sting from the leading edge and dividing that by the lift which is the sum of the lift arm force and the C. P. arm force.

In making tests for the parasitic resistances of fuselages, floats, landing gears, etc., the model is suspended in the same way as the airfoil. Usually, in this type of work, there are no forces on the lift arm so that can be neglected. In testing spheres, streamline sections, etc., the flow about the body can be determined by holding silk threads in front of the object. Turning and twisting of the threads indicate turbulence of flow.

In making tests, try to complete all tests on one particular object the same day or on the same kind of a day and at the same temperature. If one fails to do this, a fairly large error and variation of results will be obtained. The author feels certain that anyone who builds this tunnel will find his labor well spent and will learn a great deal about aerodynamics.

END.

XUM

◆ BARTER AND EXCHANGE ◆

Good Opportunities for Our Swappers

The publishers reserve the right to reject any or all notices that are not in accord with the policy of this magazine. Only trades or "swaps" will be permitted. For cash deals, buying or selling, refer to our Buyer's Directory. Readers are urged to use caution in arranging trades and references should be mutually exchanged.

AIRPLANES

ANZANI-BIPLANE, 3-place, 120 h.p. Anzani engine, in good flying condition but not licensable. Carries many instruments. Will trade for an OX-5 Eaglerock, 1927 or later, needing repairs or a light car in good condition.—A. E. Romaine, Caribou, Maine.

LIGHTPLANE OR GLIDER WANTED. Have many things to trade including radio sets, short-wave receivers, new bicycle, aviation correspondence course, etc.—Frank Storm, 1710 Harrison St., Amarillo, Tex.

CURTISS-ROBIN WANTED, less engine. Must be eligible for license, preferably uncovered. No damaged ship will be considered. Will swap instruments, Liberty engine, Hisso parts, Stromberg carbureter for Hisso.—F. T. Larr, 604 Bowmar Ave., Vicksburg, Miss.

1-PLACE SHIP OR SEDAN wanted. Will swap a low-wing, 2-place side-by-side all metal constructed cloth covered air-cooled plane. This job needs covering.—H. H. Brindley, Peabody, Kan.

AERONCA WANTED. Will swap a good Cirrus engine, 95-100 h.p., nearly complete, 2-Clark "Y" wings, 32 ft. span, control cables, lots of instruments and airplane parts. Or I will swap for a 9-cyl. Salmson engine.—LeRoy Tyler, Hobart, N. Y.

SWALLOW, OX-5 engine, 3-place, right lower wing cracked, lower left uncovered, has been hangared all the time. Also one converted Indian Ace engine with prop in good condition. Will trade for a good car or what have you?—T. W. Ball, Box 400, Alanreed, Tex.

B-1 RYAN MONOPLANE, 5-place, J-5 engine, just relicensed. Nav. and landing lights, tail wheel, steel prop, lot of instruments. Will trade for Kinner-Bird, Waco F or Warner-monocoupe.—S. H. Leslie, Pikeville, Ky.

HEATH 30, Type 1. P. O. L. M. Identification No. 11497, complete but without engine. Good instrument equipment and with two 5-gal. wing tanks. Steel welded fuselage, 18 x 4 Goodrich tires.—A. S. Decker, Jr., 401 Selma Road, Springfield, Ohio.

LIGHTPLANE WANTED, 2-place, or will consider 1-place, in fair condition. License or identfication not necessary. Have about $350 worth of model airplanes to trade.—Jack Berry, Jr., Main and Bank St., South Boston, Va.

LIGHTPLANE WANTED, eligible for license, Heath or Aeronca preferred. Will trade a 1928 Nash sedan, 6-cyl., low mileage since overhaul. Also a Crosley radio.—Joe Demic, Jr., Endee, N. M.

NEW FALCON, 2-place cabin with new 4-cyl. opposed, air-cooled engine, metal or wood prop, air-wheels, ailerons and tail group doped, fuselage and wings uncovered but have Grade A Flytex covers, factory sewed. I also have extra Continental and Aeronca props to trade. Will trade for a heavier ship in good condition, no objection to Ox job, licensed or unlicensed.—H. J. Thomas, 214 E. North St., Winchester, Ind.

CHURCH OR EAGLET, cracked or flyable. What do you want?—H. G. Warner, Fountaintown, Ind.

AIRPLANE SUPPLIES

THOMAS-MORSE WINGS, one pair, Alco sportplane plans. What have you in the way of lightplane parts?—Orville B. Kinsley, 802 16th St., Niagara Falls, N. Y.

PARACHUTE WANTED, approved type, seat-pack. Also portable typewriter. Will trade 12v. army aircraft type storage batteries, elect. motors, 7-tube all-wave super-het, Earl radio, radio parts, etc.—C. R. Dickson, 439 N. Lombard Ave., Oak Park, Ill.

WING RIBS. One set of poplar ribs, 5-ft. chord, 28 ribs in set. Will trade for lightplane parts.—Eberhardt Walter, 9 Mill St., Walterboro, S. C.

STANDARD J-1 PARTS, instruments, gas tanks, 180 h.p. Hisso, tires, wheels, etc. Will trade for model airplane supplies, typewriter or what have you?—Armand A. Devilets, 90 Barrows St., N. Attleboro, Mass.

LIGHTPLANE PLANS, Rathel 2-place plans, Low-Wing Air-Dale racer plans, Baby Lark biplane plans, Guardian 2-place monoplane plans, book on "How to Build and Fly Gliders", old coins, opera glasses, magazines. Will trade for an air-cooled motorcycle engine, 18-28 h.p. converted or not converted or a Lawrance engine.—Pete Onderak, 4454 W. 28th St., Cleveland, Ohio.

PIETENPOL PARTS, fuselage, wings with ailerons, tail surfaces and center section struts. Ship about three-quarters finished. Will trade for a light car or what have you?—James J. Wray, 22 Crescent St., Worcester, Mass.

PLANS for the Kamm parasol, also books. Will trade for goggles.—Lyle Miller, Route 2, Shelby, Nebr.

AUTOMOBILES

1928 OAKLAND SEDAN. Will trade for a lightplane and will add cash if plane is worth it.—Michael Gunther, 6 Linden St., Hudson, Mass.

1929 WHIPPET 6, sport coupe, A-1 condition. Will trade for a lightplane in good flying condition. I also have a typewriter, guns, etc., to trade for aircraft instruments, Maytag motors or what have you?—Jack Foster, RFD 3, Fulton, Ky.

A CHARGE of one cent per word will now be made for all advertisements entered in the Barter and Exchange columns. Please enclose remittance on this basis when submitting copy.

POPULAR AVIATION
608 S. Dearborn St.,
Chicago, Ill.

1928 NASH SEDAN, 6-cyl., low mileage since overhaul. Also a Crosley radio. Will trade for a lightplane eligible for license, a Heath or Aeronca preferred.?—Joe Demic, Jr., Endee, N. M.

BUICK RACER in good condition, emery wheel and a No. 3 Eastman folding Kodak. What have you?—Legare Hoge, Summerville, S. C.

MIDGET CAR PARTS, wheels, new tires and tubes, front axle, set of springs, steering gear and other parts for a midget car. Will trade for a used motorcycle or 50 h.p. Velie engine.—Francis Johnson, 2015 Carlton Ave., Cloquet, Minn.

CAMERAS—MOVIES—OPTICAL GOODS

KEYSTONE MOVIE PROJECTORS, (2), in good condition and with over 1,000 feet of film, varied subjects. Will exchange for model airplane supplies, plans or what have you?—Bruce Wilder, Royston, Ga.

MOVIE PROJECTOR, 35 mm., 1,000 feet of film, magazine, motor driven, suitcase type. Also one Powers 6B, projector, motor drive, 35 mm. in good condition. Will trade either machine for an outboard speed boat or will barter everything for a small launch.—Drew E. Kolb, 712 Locust St., Williamsport, Pa.

TELESCOPE OR FIELD GLASSES WANTED. Will trade 36 copies of POPULAR AVIATION.—L. Russ Lyckman, RFD 1, Brady, Tex.

MOVIE CAMERA, 35 mm. Also a .22 Stevens rifle and some other things to trade for an Indian or Harley of 1927 or later.—J. E. Konkle, 91 Wetmore Rd., Columbus, Ohio.

ENGINES, MOTORS, ACCESSORIES

BICYCLE ENGINE WANTED in exchange for a jig-saw and 1-4 h.p. electric motor. Also have electric train and accessories.—W. F. Sheratt, care of W. F. Rasemer, 505 Meade St., Monongahela, Pa.

GNOME ENGINE, 9-cyl., brand new, 165 h.p., never been used. What have you?—O. Matson, Glenwood, Ill.

BICYCLE ENGINE WANTED. Will trade a Model 70 Stevens rifle, 16 shot.—Curtis Tucker, Howe, Nebr.

SMALL MOTOR WANTED, any type. What do you want in return? Will spend some cash if necessary.—Alvin Schmultz, 271 Wycombe Ave., Lansdowne, Pa.

ENGINES—PARTS. 3-Frontenac heads, 8-valves, Mags, carbs and racing parts. Old 2-cyl 1902 Maxwell automobile in running condition, complete except tires. I want airplane parts.—Odus Burggraf, 384 Girard Ave., Marion, Ohio.

MOTORCYCLE ENGINE WANTED, 2-cyl. I have much to trade. What do you want?—Milton Price, Willow River, Minn.

FORD ENGINE, Model T, not converted, suitable for ice-sled or wind-wagon. Will swap for light motorcycle or what have you?—Fred Priebe, Jr., Neshboro, Wis.

ACCESSORIES, I have a "T" carb, 4-cyl Apollo mag, 1-tube short-wave radio, 200 magazines. I want a parachute or what have you?—J. Norwood Reynolds, Clinton, N. C.

EVINRUDE OUTBOARD ENGINE, 22 h.p., needs slight repairs. Wish motorcycle, lightplane engine or parts. What have you?—Orville B. Kinsley, 802 16th St., Niagara Falls, N. Y.

HUPMOBILE ENGINE, 4-cyl., ideal for boat, also two automobile generators, cone type radio speaker, one 5-tube Freshman radio set, etc. Will trade for any type of outboard engine in running condition.—Arthur H. Shulman, Suite 7, 2 Hancock St., Malden, Mass.

GLIDERS—HEDGEHOPPERS

PRIMARY GLIDER PARTS WANTED, complete sections or parts. Will trade completed models of any type desired.—Williams Aircraft, 118 Edgemont Road, Upper Montclair, N. J.

PRIMARY GLIDER, semi-finished, including 2-15 foot wings, fuselage and tail. Uncovered. Also a Radiola battery set with phones. Will trade for a motorcycle in running condition or what have you?—Harry Bauman, 2417 64th St., Brooklyn, N. Y.

HEDGEHOPPER, 18 ft. span. Will exchange, plus some cash, for a good used primary or secondary glider. The hedgehopper is minus the landing gear, gas tank and covering. Built from plans in Practical Mechanics. Engine and prop installed. A 6-tube Stewart-Warner radio will also be included in the trade.—George E. Harris, 42 Cambridge St., Valley Stream, N. Y.

HANG GLIDER WANTED, a motorcycle or a Heath wing or fuselage. Will trade about 200 magazines, aviation books, models, Stevens 0.22 rifle and set of mechanic's tools.—Royce L. Gibbs, R-6, N. Elmira St., Burlington, N. C.

MISCELLANEOUS

CONSTRUCTION-CHEMISTRY KITS. Will trade a No. 5 Mecchano set complete, a No. 1 Gilbert Chemistry kit, mechanical magazines and a 2-tube radio transmitter for a Harley-Davidson 74 Twin motorcycle, not later than 1930, in good running order.—Allen Flitdorpt, RR-1, Roann, Ind.

PROSPECTOR'S COMPASS, improved dip needle type, valued at $35. Will trade for corres. course in aviation by the Dayton School or

Aviation Institute. Will also consider books.—Martni Cosgrove, Oselousas, La.

GOGGLES. Commander I, in aluminum case, meniscus lens, like new. Sells for $30. What have you?—H. D. Barton, 639-26, Des Moines, Ia.

MISCELLANEOUS. $18 goggles, boar handled hunting knife, 6 models. Two of the models are of hollowed balsa and cost me $9 each. Total cost of articles $54. Will swap for a late Indian or Harley motorcycle.—Jacques Juriga, 877 N. 1st St., Rear 1, Philadelphia, Pa.

MOTORCYCLES

MOTORCYCLE WANTED. Have a 0.22 Stevens rifle, Indian speedometer, 1-4 h.p. motor, Balsa wood, a 35 mm. movie camera and books. This must be an Indian or Harley, 1927 or later, in running condition.—J. E. Konkle, 91 Wetmore Rd., Columbus, Ohio.

MOTORCYCLE WANTED. What do you want? Raymond W. Boberg, Route 2, Arcadia, Wis.

1931 INDIAN SCOUT, Model 45, will trade for a lightplane in good condition.—Joseph W. Comiskey, 3504 S. Mozart St., Chicago, Ill.

INDIAN 45 HILL CLIMBER to trade for a Heath or Pietenpol plane, or a cracked large plane. Motorcycle now undergoing complete overhaul after being used as a 23 cu. in. racer. —Harold Higley, Kent, N. Y.

MUSICAL INSTRUMENTS

MUSIC STAND or 6-sheets of airplane paper to trade for photos of airplanes, back issues of P. A.—Chas. Hoge, Summerville, S. C.

CONN TROMBONE, ballroom model, brand new with case, lyre, three mouth-pieces, etc. Will trade for a converted Henderson engine with prop, or an Indian Scout no older than 1928.—Norman Kasiner, 179 Crawford St., Rochester, N. Y.

SAXAPHONE, Buescher C-Melody, silver-plated. Cost $124.50 new. Will trade for motorcycle or small car.—Russell H. Krebs, 5347 Devonshire Ave., St. Louis, Mo.

SLIDE TROMBONE, Liberty Conn with case, good as new. Will trade for a short-wave radio transmitter or other radio parts.—Clarence Touw, Platte, S. Dak.

UKELELE and a pair of powerful field glasses. Would like a small gasoline engine. What have you?—Philip Soccoccio, 58 Vewena St., Cranston, R. I.

U. S. ARMY BUGLE, shotgun, fishing equipment, bicycle parts. Wish a one or 2-cyl. motorcycle. Will pay difference in cash if the motorcycle is worth it.—Royal Hilliard, Sweet Grass, Mont.

BUESCHER TRUMPET, silver plated, with case. Now worth about $75. Will trade for a good cycle.—Edwin Kelley, 3 Winter St., Dorchester, Mass.

STRADIVARIUS MODEL VIOLIN, cost $30, case and instruction books, ukelele, 30 model magazines and some coins. Will trade for a piano accordion.—Walter G. Zapoloki, 882 Madison St., Brooklyn, N. Y.

UKELELE, 10 airmail envelopes with different cachet, boys books, flashlight. Will trade for a solid scale model of a P6E. Frank Law, Loomis, Cal.

WEYMAN TENOR BANJO, new, cost $85. Will trade for a motorcycle in good condition.—Lute Ludwig, Strasburg, Va.

BANJO-MANDOLIN, worth $17, also a high-power flashlight. Will trade for books on aviation or flying models and $6 in cash.—Chas. Berquist, 1382 Flatbush Ave., Brooklyn, N. Y.

VIOLIN. Will trade for a good used outboard motor. This violin is valued at $125 and includes a $10 leather case. In first class shape.—Homer Keel, Jr., 109 W. College Ave., Longview, Tex.

TENOR BANJO, cost $45, will trade for a Model A Ford engine or for a 6-ft. prop and hub to fit Model A. Also a new 0.22 automatic rifle costing $27.50 for Air Camper wings or fuselage.—Wm. Van Valkenburg, Slingerlands, N. Y.

HOHNER ACCORDION, 32 melody with complete instructions. Will trade for motorcycle not later than 1928, an auto or airplane parts. —W. Shwetz, 758 E. 79th. St., Chicago, Ill.

PHOTOS—PICTURES

PHOTOS WANTED of American and world aeros, postcard size. I also want back numbers of POPULAR AVIATION and a flying scale model of the Northrop Gamma or others.—E. V. Smith, "The Rowans", Oulton Cross, Stone Staffs, England.

AIRPLANE PHOTOS, I have photos like the Nieuport, Doolittle's Gee Bee and others. Will swap for photos of all types of planes.—Robt. Kappeler, 909 Walnut St., Dover, Oho.

NEGATIVES AND PHOTOS WANTED. Also want aeronautical books of any date. Send list of photos. What do you want?—Howard G. Hemming, 70 Anita St., New Haven, Conn.

PHOTOS WANTED of modern commercial, military and racing planes. What have you?—Norman Barker, 139 Evans Ave., Toronto, Ont., Canada.

PHOTOS, No. 11, clear and mostly side views of planes. Includes Stinsons, Moths, Gee-Bee's, Travel Airs, Cessnas, Aeroncas, Douglas, Davis, Monocoupes, Pitcairns, etc. I want plans, particularly plans for a Cessna AW, pictures or parts of airplanes. What have you?—Thomas Skilton, Summit Ave., Paoli, Pa.

PHOTOS WANTED of J. J. Mattern and plane, also photos of the Akron, Boeing P12-B, P12-C, P12-E and P12-F. Will trade other photos, what do you want?—Al Bachmann, 410 W. Ferry St., Buffalo, N. Y.

PHOTOS. 25 different kinds, Size 116, of modern commercial planes. Would like goggles in trade, or what have you?—Stanley Smith, R 6 William St., Cornwell Heights, Pa.

PHOTOS TO SWAP. Will exchange photos of all sorts of planes, but preferably war types. —George Meese, 323 Karl Court, Dover, Ohio.

SHENANDOAH WRECK PICTURES WANTED Genuine photos taken at wreck or newspaper clippings illustrated with report of disaster. Have plane photos or what else do you want in trade?—Bill Metzger, 1547 Mars Ave., Lakewood, Ohio.

POSITIONS WANTED

POSITION with barnstormer as a parachute jumper in return for flying lessons. Am a young man, average size, sociable, interested in work.—H. C. Carr, Bismark, Mo.

COLLEGE GRADUATE, 36, expert mechanic, electrician and radio man. Wartime instructor at Tulane University. Speaks Spanish and French. Will exchange work of any kind for flying hours.—Fritz Faleon, White Castle, La.

FARM BOY, 18, will exchange hard work anywhere in U. S. A. for used lightplane, engines, car, instruction in aviation or anything that is of some use.—P. Harbula, Penns Grove, N. J.

RADIO APPARATUS

CONDENSER, 3-gang, straight-line frequency, 17 plate. Will trade for a good helmet, size 7 3-8 or larger with goggle straps or a good pair of rubber bound goggles.—J. W. Anderson, Box 452, Brawley, Calif.

SHORT-WAVE STATION complete, with panel type transmitter, 2-receiving sets, wavemeter, monitor, etc. Includes lots of extra parts and hundreds of aviation, radio and engineering magazines. I want sporting goods like a high power rifle, binoculars or an outboard engine.—W. L. Holst, 6142 Forest Glen Ave., Chicago, Ill.

MAJESTIC RADIO, model 52 in A-1 cond., also a Sparton Bugle car horn and some rifles. Will trade for a lightplane engine.—Don Ashcraft, Box 233, Kingman, Kas.

RADIOLA 26, super het or an Atwater-Kent 37. Will trade for a Lawrance 25 h.p. opposed engine. Other 2-cylinder engines will also be considered.—R. Manka, Box 452, Lamar, Colo.

6-TUBE BATTERY SET. Will trade for primary glider plans.—Leo Hemmbrick, Box 287, East Northport, L. I.

B-ELIMINATOR, transmitter parts, an aviation book, to trade for books on aviation, meteorology or Jewell meters.—Wm. A. Langer, W9DGS, 308 First Avenue, South Jamestown, N. Dak.

4-TUBE RADIOS (2), A. C.-D. C., weight 5-lbs., built-in speaker, value $25. What have you?—Geo. Beyers, Jr., 1516 Sycamore, N. Little Rock, Ark.

PHONE TRANSMITTER, S. W., 7 1-2 watt, and a 4-tube S. W. receiver. Will trade for lightplane, less engine, lightplane parts, Harley-Davidson motorcycle or what have you?—R. Reiter, 227 A West Kingman, Kas.

1-TUBE RADIO SET, and an "Easy Course in Home Radio", some radio parts. Will trade for anything pertaining to aviation.—Arnold W. Shoemaker, Burlington, N. C.

BOSCH AUTO RADIO WANTED or racing equipment for Model A Fords. Will trade a 9-tube radio, spare parts for motorcycles, several Model T racers and a lot of Heath airplane parts.—Bill Sockwell, 236 N. Edgeworth St. Greensboro, N. C.

RADIOLA, 2-tube battery type and radio parts to trade for an Eastman folding camera of vest-pocket size.—Doyle Babb, Rising City, Nebr.

RADIO TUBE AND SET TESTER, S. W. Receiver, S. W. Transmitter, 2-electric motors, 4-cyl. watercooled engine, 1 4-cyl. air-cooled engine, a light metal electric welder and a 72 key concertina. Will trade for a lightplane in flying condition.—J. Kosach, Jr., Care of POPULAR AVIATION.

FRESHMAN MASTERPIECE, 5-tube and radio parts. Will swap for a light air-cooled engine for lightplane.—Thos. Sikora, Braidwood, Ill.

AIRCRAFT RADIO RECEIVER, worth $150, to trade for a late model Graflex camera or late model portable typewriter in good condition.—W. L. Knotts, Box 333, Garden City, Long Island, N. Y.

CROSLEY RADIO, 4-29, S-C 3,000 ohm headset, trickle charger, Crosley magnetic speaker. Will exchange technical books on aviation, or a lightplane engine.—John R. Moore, Canneltown, W. Va.

STAMPS AND COINS

600 STAMPS, including airmails, triangles and stamps from the Far East, will be swapped for a Liberty Head nickel or five Indian pennies of any date.—Edward Folieski, 842 Price St., Dickson City, Pa.

148 STAMPS, all different, will trade for a Flying Manual later than 1930.—Wesley Blume, Route No. 1, Box 231, Kent, Wash.

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XUM

Navigation

(*Continued from page* 167)

radio for your navigation. Neither can you depend solely on dead reckoning or on celestial navigation. All three methods are necessary on a long flight, and sometimes all three methods will not be enough.

On an extended flight, you should use celestial navigation as well as radio and dead reckoning. This method requires more equipment than dead reckoning, but less than radio. No one operation of celestial navigation is particularly difficult, yet it is not an easy matter to accomplish efficient navigation by means of celestial bodies in flight. All the details cannot be given here, yet the equipment can be listed and the general idea presented.

Charts, pencils, dividers, watch, and the aircraft plotter or other means for drawing courses etc., used for dead reckoning will also be needed for celestial navigation. In addition, the sextant, the Air Almanac and means for reducing observations to positions will be needed.

The sextant is used to measure the altitude in arc of the celestial body above the horizon. Where the natural horizon is not visible, an artificial one is substituted in the form of a bubble. Since the bubble is affected by acceleration, the sextant is not as accurate as desired and this instrument therefore remains the weak link in air navigation.

The Air Almanac gives the location of the heavenly bodies with reference to the meridian of Greenwich and the equator. In other words, the Air Almanac might be said to give the latitude and longitude of the celestial bodies. With the position of the observed body found from the Air Almanac, with the time of observation and with its altitude above the horizon, there are several sets of tables, such as the Line of Position Book by the writer, which may be used for reducing the observations to positions. For the details of how this may be done, the reader is referred to the text-book, Air Navigation.

Since the stars remain approximately in the same position from year to year, special and easy methods may be employed in their case. For example, the Star Altitude Curves afford a means for determining a position in a minute, without calculation. This method of fixing position is so simple that it is believed that the student will be able to understand it from the illustration without any extended study. The curves are positions on a chart corresponding to the altitudes of stars for various times.

With the equipment and knowledge as outlined, we will now give a summary of what the navigator of the plane might do, whether this navigator is Mr. or Mrs. John Doe. The plane may leave any point and set a direct course to any other point and by altering this course as found necessary by positions established by radio or celestial navigation or by drift observations, the plane may be kept on or near the desired course continuously.

The plane so equipped should be able to take off in a fog, fly above the clouds, and fly to any desired destination within the range of the plane on the most direct route. Needless to say, with the efficient long range planes now available, it becomes more and more necessary for these planes to be equipped and manned for efficient navigation. Planes not so equipped and manned are a menace to life and this lack detracts from their value.

END.

Hawks' Ship

(*Continued from page* 184)

The control unit includes a switch for turning the robot on or off, another switch regulating climb or descent and a compass. The course on which the compass is set is automatically followed even to a 90 degree turn.

On his flight, Hawks turned the controls over to the robot when he was above the Rocky Mountains and occupied himself only with the navigating until he reached the Alleghenies. With darkness falling, he again took the stick. Reviewing the use of the robot, Hawks said much experimentation remains to be done before automatic control of an airplane is perfected, although in the meantime the apparatus can be put to satisfactory practical use.

"Obviously," Hawks said, "the robot won't do the navigating nor anything else requiring mentality, but in the natural conflict between what a pilot's senses tell him and what the instrument shows him when he begins blind flying, the robot will be especially valuable. The robot flies blind better than we do because it hasn't brains enough to make a mistake.

"We will have to learn to place faith in the robot, just as we had to learn to have faith in our instruments in blind flying. When we acquire that faith and when automatic control is more perfected, we will have safer flying in bad weather and a great measure of relief in the fatigue of a long air trip. By way of illustration, it might be said that in good weather the normal flying of an airplane is a physical job and the navigation is a mental task. In bad weather, the flying is both a physical and mental strain, which leaves no reserve faculty for navigating. Under this condition, we'd turn the controls over to the robot and let it fly the ship."

These observations occurred to Hawks during his latest flight, which, incidentally was the fourth non-stop coast-to-coast journey by the noted pilot.

END.

Stan Rowan

(*Continued from page* 186)

There was room on the floor for making one wing, so I built one to completion and hung it up on the wall. Then I built the other one the same way, and one of the pictures shows one of the wings hanging on the wall. I started on November 22, 1930 and I expected to finish in about ten months, but I certainly fell down on that estimate. Two years and ten months would be more like it, hampered as I was by left-handed working conditions. At this writing, July 11, 1933, I still have to put the skylight on.

I picked out the bolted type of fuselage because I could not do welding in my bedroom and this involved a lot more work, but it was my only choice.

From now on, after this struggle, I don't know what the word "can't" means. It's good training in everyway to just say to yourself, "I'm going to get into aviation or bust," and when you say it—mean it. But as I need still more money than I am earning at present, to get my flivver into the races, I have worked out a new scheme.

To get going before the plane is finished, I bought a new Irvin seat-pack parachute. Then I am going to try to chisel out a chance to make a high altitude parachute jump at the races. I will try to beat Bert White's record, but just at the present time I am temporarily up against it again, for I have no way of getting up there.

The only reasonable way that I can think of is to make an arrangement with the Army to take me up, for the Army certainly has the equipment and will surely be at the races. When I get down, I'll talk to the crowd through the microphone and at the same time will have my Heath lined up for the race. The announcer will be tipped off that my race entry has been built in a bedroom of a rooming-house and then the crowd will sit up and take notice. I should be able to put up a sufficiently stirring story to get the support of a few hundred people out of 75,000, and then I'll give them a clear picture of the obstacles that surround the amateur. If I can get away with this, it will be a real story.

END.

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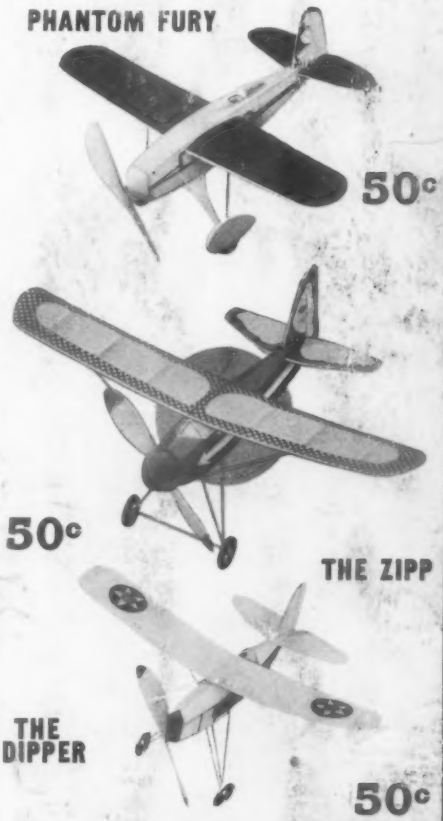

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